Vol. II.—No. 8.] [MARCH, 1878.

THE

MINERALOGICAL MAGAZINE

AND

JOURNAL

OF THE

Mineralogical Society

OF

GREAT BRITAIN & IRELAND

INSTITUTED 3rd FEBRUARY, 1876.

EDITED BY THE HON. SECRETARY.

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THE MINERALOGICAL SOCIETY

Mineralogical Society of Great Britain & Ireland.

—o:—

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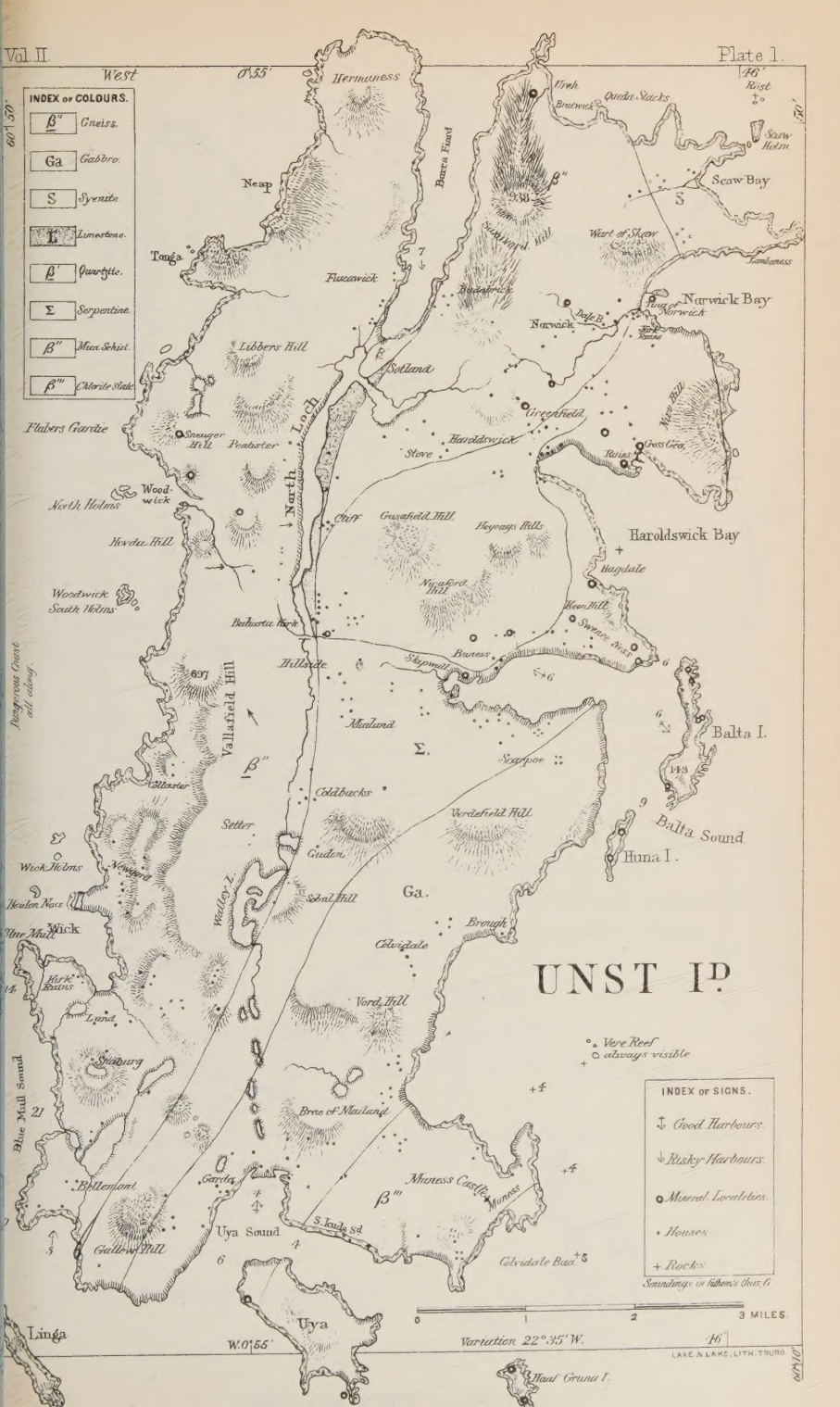
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Pund Voare
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Buddarick
Libbers Hill
Sutland
Flubers Gardie
Snuggar Hill
Peatister
North Loch
Greenfield
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Gross Geo
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North Holms
Herdie Hill
Cliff
Gusafield Hill
Heyoays Hills
Haroldswick Bay
Hagdale
Woodwick South Holms
Nisafard Hill
Heen Hill
Swaare Moss
Balhasta Mark
Hillside
Dangerous Coast all along
Skipwell
Vallafield Hill
Maiuna
Balta I.
Stapfoo
Wilster
Coldbucks
Balta Sound
Setter
Verdefield Hill
Huna I.
Wick Holms
Wadford
Guden
Heulen Ness
Wick
Blue Mull
Shal Hill
Ga.
Wadley L.
Brough
Celvidale
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Sibburg
Blue Mull Sound
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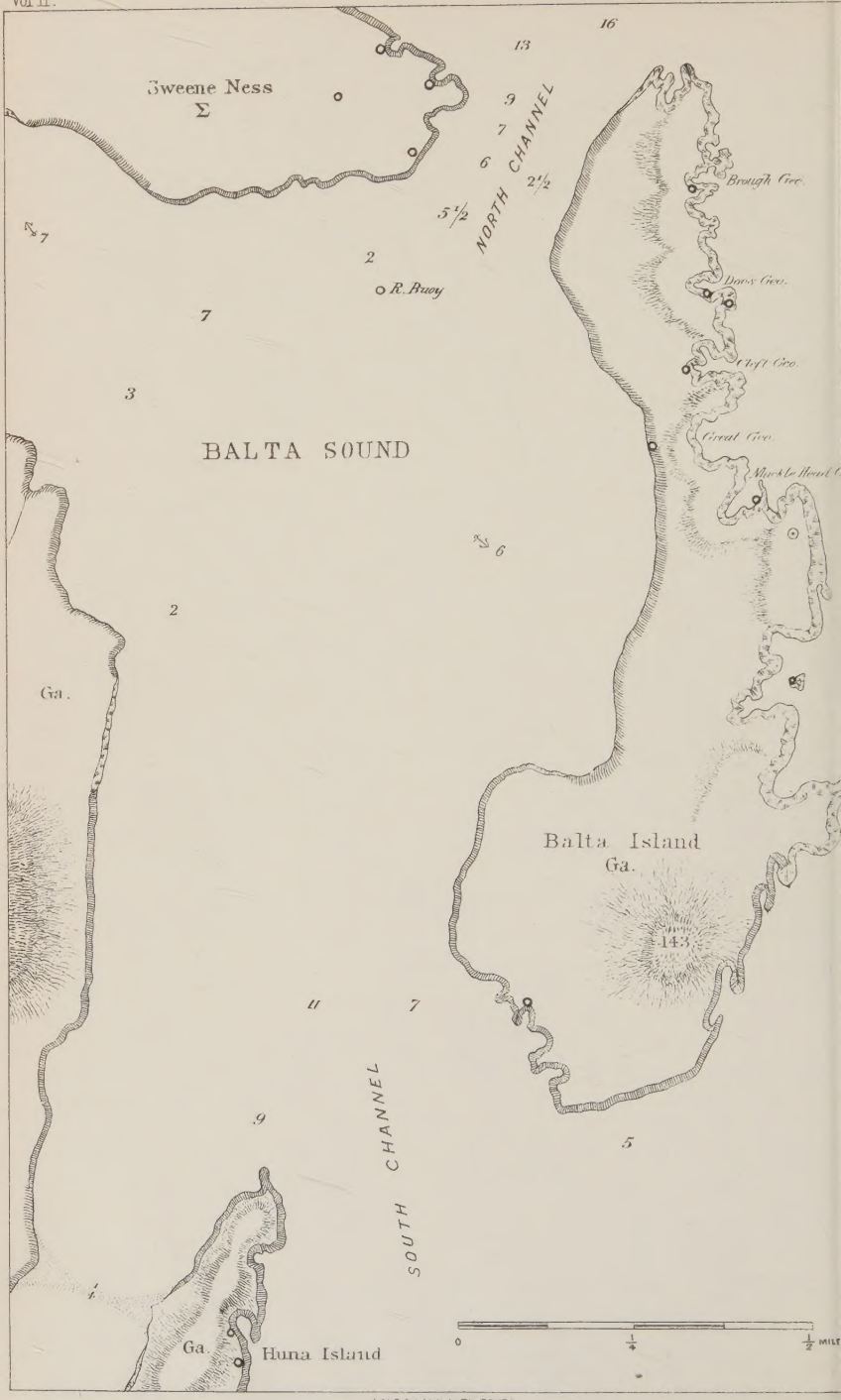

LAKE & LAKE, LITH. TRURO

[*Copied from original colour plate.*

PROCEEDINGS

OF THE

MINERALOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

1878.

EXCERPT MINUTES OF COUNCIL MEETING.

Held in the Rooms of the Royal Microscopical Society, King's College, London, February 19, 1878.

Mr. H. C. Sorby, F.R.S., *President*, in the Chair.

Resolved—That the following gentlemen having been duly proposed in accordance with Rule V be elected, viz :—

MEMBERS.

Dr. Theodor Schuchardt, of Görlitz, Prussia.
Mr. James Osborne, of St. Austell, Cornwall, and Rio Tinto, Spain.
Sig^r. Giorgio Spezia, of Turin, Italy.
Mr. Jas. I'Anson, of Darlington, Durham.
Mr. John Milne, of Tokio, Japan.

ASSOCIATE.

Mr. Harry Teague, of Perranzabuloe, Cornwall.

Resolved—The accompanying statement of account having been duly audited, was ordered to be printed and issued to the members.

Resolved—That in future the Journal be not issued to any members who shall be more than twelve months in arrear with their subscriptions.

GENERAL MEETING.

Held at King's College, February 19, 1878.

Mr. H. C. Sorby, F.R.S., *President*, in the Chair.

The following papers were read—

By the President—"On the determination of the minerals in thin sections of rocks by means of their indices of refraction."

By the Rev. T. G. Bonney—"On some specimens of gabbro from the Pennine Alps."

By Mr. J. H. Collins—"On mineral classification."

Specimens in illustration of their papers were exhibited by the President and by the Rev. T. G. Bonney.

Dr. Foster exhibited specimens of Scheelite, Carbonate of Bismuth, and other minerals from new Cornish localities.

Mr. Collins exhibited some remarkable crystals of Cassiterite from St. Austell Consols, Cornwall.

BOOKS RECEIVED.

From *the Royal Society of New South Wales, Sydney.*
Progress and Resources of N.S.W.
Journal and Proceedings, Vol. X, 1876.
Report of the Department of Mines, 1876.

From *Prof. J. D. Dana, Newhaven.*
American Journal of Science, Dec., 1877, to March, 1878.

From *Reale Comitato Geologico d' Italia, Rome.*
Bolletino, 11, 12, 1877.
„ 1, 2, 1878.

From *the Societé Géologique de Belgique, Liege.*
Annales, Tome 1.

From *Dr. C. A. Burghardt, Manchester.*
On the origin of some ores of Copper. Part 1.

From *Prof. Henry How, D.C.L., Windsor, N.S.*
Report of the Department of Mines, 1877.

From *Prof. Kjerulf.*
Om Stratifikationens Spor.

From *Prof. Groth, Strasburg.*
Zeitschrift fur Kryst. und Min., Heft 1, Band 2.

From *the Leeds Naturalists' Club.*
Constitution, 1876.
Annual Report, 1875-6.
Annual Report, 1876-7.

From *Mr. W. D. Roebuck, Leeds.*
Locusts in Yorkshire.

STATEMENT OF RECEIPTS AND EXPENDITURE TO DECEMBER 31st, 1877.

Dr.	£	s.	d.	Cr.	£	s.	d.
By Balances from 1876	118	10	3	To Lake & Lake, for Printing and Stationery	57	10	2
,, Composition Fees	21	0	0	,, Investment in 3½ per cents.	105	0	0
,, Subscriptions for 1877	64	0	0	,, Dovey, for Deed Box	1	1	0
,, ,, Arrears	16	5	0	,, Carriage of Parcels, Circulars, and Letters	7	1	7
,, Authors' Reprints, &c.	2	0	0	,, Postage of Magazines	6	1	9
				,, Travelling Expenses	3	18	6
				,, Clerical assistance and Sundries	3	2	0
				,, Balance at Bankers' £8 9 7	38	0	3
				,, ,, in Treasurers' hands 29 10 8			
	£221	15	3		£221	15	3

Examined, and found correct. BENEDICT KITTO,
F. W. RUDLER.

ASSETS.				LIABILITIES.			
Balances as above	38	0	3	Printing and Stationery	64	0	3
Subscriptions considered good	60	0	0	Balance	39	0	0
Due for Magazines, &c.	5	0	0				
	£103	0	3		£103	0	3

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VOLUME I

OF THE

MINERALOGICAL MAGAZINE

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STODDART. Celestine in the Keuper marls

FOSTER. New Minerals and Mineral localities in Cornwall and Devon

COLLINS. New Minerals from West Phœnix Mine, and from St. Agnes

COLLINS. Occurrence of Scorodite, Pharmacosiderite, and Olivenite in Greenstone, at Terras Mine, St. Stephens

VIVIAN. Paragenetic formations of carbonate of lime and oxide of iron, and of quartz and oxide of iron, at the Mwyndy iron mines, Glamorganshire (Illustrated)

FOSTER. New form of Blowpipe Lamp (Illustrated)

DUDGEON. Occurrence of Gold in the South of Scotland

HEDDLE. How and where to collect Minerals in Scotland

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CHURCH. Analysis of a Serpentine from Japan

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HANNAY. Examination of the Hydrous Constituent in Minerals (Illustrated)

HANNAY. On an easily constructed form of Reflecting Goniometer (Illustrated)

DAVIES. Notes on Vauquelinite from Scotland, and Cantonite from Cornwall
COLLINS. Note on certain Black Quartz Crystals from Boscaswell Downs, Cornwall (Illustrated)
VIVIAN. Further notes on the Oxides of Iron, enclosed in Quartz, at Mwyndy, Glamorganshire (Illustrated)
WARD. Notes on the Occurrence of Chlorite among the Lower Silurian Volcanic Rocks of the English Lake District
MELLO. Note on a peculiar form of Quartz Crystals from Australia (Illustrated)
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THE MINERALOGICAL MAGAZINE

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MINERALOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

No. 8. MARCH, 1878. Vol. II.

I.—*On the determination of the minerals in thin sections of rocks by means of their indices of refraction.*

By H. C. Sorby, F.R.S., President G.S., &c., &c.

In my address at the Annual Meeting of the Mineralogical Society last year, in Plymouth, I gave an account of a new method of studying the optical properties of minerals, and of determining their indices of refraction. I then showed that an approximate knowledge of these characters would, in many cases, enable us to identify minerals with great confidence, and also would sometimes furnish us with valuable hints as to their general chemical composition. My remarks had reference exclusively to detached specimens of more or less considerable thickness, and I scarcely thought that it would ever be possible to apply this method successfully with comparatively high powers in the case of thin sections of rocks. I feared that certain errors, which appeared to be unavoidable, would then become so great in proportion to the difference in the indices of many of the commoner minerals, that it would be impossible to distinguish them with confidence. However, at length, I have found that it is possible to so far simplify the method that the necessary data can be obtained by much fewer measurements than I expected, and the errors so far reduced that even in sections $\frac{1}{400}$th of an inch in thickness, the constituent minerals may be identified in a very satisfactory manner, if they have a clear transparent area of only $\frac{1}{500}$th inch.

Instead of measuring the thickness of the specimen and the amount of the displacement of the focal length of the grating as seen through it by means of a graduated scale and vernier, I measure them by means of the rotation of the graduated circular milled head of the fine adjustment screw. This does not, indeed, give the same linear values in the upper aud lower part of its range, but the difficulty may be easily overcome by measuring the amount of the displacement of the focal length when the milled head is both at the upper and lower part of the range of its movement required to measure the thickness of the specimen, and taking the mean of the two slightly differing values. Though individual observations may differ considerably more, yet by taking the mean of a number, I think each determination may be made within less than $\frac{1}{10,000}$ of an inch; that is to say, I do not think it ought to be difficult, with proper care, to determine the thickness of the mineral and the amount of the displacement of the focal length to less than $\frac{1}{10,000}$th of an inch. In a section $\frac{1}{100}$th of an inch thick this would give an error of only a unit or two in the second place of decimals of the index of refraction. By increasing the number of separate observations, an equally accurate result may be obtained, when the section is not more than $\frac{1}{400}$th of an inch thick, by using a sufficiently high power.

a. Somewhat thick sections.

In applying this method we must slightly vary the system according to the thickness of the specimen. Thus, for example, if we wish to ascertain the value of the indices of such a partially transparent mineral as Labradorite, we may prepare a section of about $\frac{1}{50}$th of an inch in thickness, and take care that the balsam between it and the upper and the lower glasses is as thin as possible. After having mounted over it the thin covering glass, made larger than the specimen, so as to project somewhat beyond it, the balsam between the glasses is cleaned away up to the edge of the mineral by means of alcohol, so as to leave a clean vacant space between the two glasses. The thickness of the specimen near the edge is then measured by the difference in the focal length for the particles of dust on the lower side of the covering glass and on the upper side of the glass slip. The displacement in the focal length due to the mineral is then ascertained by viewing the lines of the grating, first through the two glasses alone, and then through the mineral. By this means we avoid all necessity to measure the thickness of the covering glass.

If the index of the mineral is not widely different from 1·5 or 1·6, and the balsam between it and the glasses relatively very thin, its influence may be neglected; or, if need be, its thickness may be measured and a suitable correction made; but when the section is very thin, the chances of error due to this source become relatively great, and it is therefore better to adopt another system.

b. Very thin sections.

If a section be less than $\frac{1}{100}$th of an inch in thickness, it is better to adopt one or other of two different methods, in which the thickness of the upper and lower balsam may be entirely disregarded. If the balsam between the two glasses, beyond the edge of the specimen, be known to be hard and brittle, its index of refraction is about 1·54, and that of any mineral may be learned by comparison in a very simple manner.

The thickness of any transparent substance, as determined by measuring the difference in the focal length for the upper and lower surface *as seen through itself*, is not the true thickness, but its real thickness divided by its index of refraction. The apparent thickness (t, t^1) of two equally thick objects therefore varies inversely as their refracting powers (μ_1 μ^1). Hence, if the value of t and t^1 and of μ be known, that of μ^1 can easily be calculated from the equation

$$\mu^1 = \mu \frac{t}{t^1}$$

In the case of an object mounted with balsam, in the manner named above, the value of t^1 is ascertained by measuring the difference in the focal length of the upper and lower surfaces of the mineral. The difference in the focal length of the grating, as seen through the mineral and through the balsam alone, is then measured and supposed to be *d*, which is positive or negative, according as the index of refraction of the mineral is greater or less than that of the balsam. We thus obtain the equation

$$\mu^1 = \mu \frac{t^1 \pm d}{t^1}$$

from which μ^1 can be calculated.

The two principal sources of error in this case are any want of absolute parallelism between the upper and lower glasses, and any variation in the index of the balsam from what is supposed to be true; the former error may be avoided by selecting portions of the specimen which are very close to the edge, and if there be any doubt about the index of the balsam, it should be determined by a special series of appropriate measurements.

In many cases, however, we may determine the index of some unknown mineral by comparing it directly with some other known mineral lying in close proximity in the thin section of rock. For this purpose quartz is often very suitable, since its index varies very little. Of course the same equation must be employed only the value of μ is 1·55. We may in like manner make use of any other mineral, if its index of refraction is sufficiently well known, or has been previously determined.

Examples.

It will, I think, be best to give a few examples of the application of these methods in the case of a section of dolerite from Glasgow, about $\frac{1}{400}$th of an inch in thickness.

I found that the index of a colourless transparent mineral, filling up cavities between the original minerals, was about 1·48 or 1·49. This exactly corresponds with that of analcime, with which its other optical characters agree.

Another colourless mineral, also filling cavities, was found to have the indices and other characters of calcite.

A third colourless mineral, evidently an original constituent, was seen to have a comparatively feeble double refraction, and its index was found to be 1·61. Its general appearance was like that of some felspar, but this index clearly proves that it cannot be felspar which contains any considerable amount of alkali. The index of labradorite was not previously known, but is I find 1·61, and therefore there can be little doubt that the mineral in the section is that felspar.

The section also contains a number of transparent reddish-brown crystals, their index of refraction being about 1·79. This and their other optical characters closely agree with those of the dark augite in the lava of Vesuvius.

It will thus be seen that this new method of study furnishes us with a most valuable means for identifying minerals in thin sections of rocks. Of course great care is necessary in making the measurements, and great attention must be paid to many details which could not be described in such a short communication as is desirable on this occasion.

II.—*On some specimens of Gabbro from the Pennine Alps.*

By Prof. T. G. Bonney, M.A., F.G.S., Fellow and late Tutor of St. John's College, Cambridge.

SOME time since Capt. Marshall Hall called our attention to Arolla, in the Pennine Alps, as a locality interesting to mineralogists.* I venture, then, to offer you a brief note on one of its rocks, collected during a visit in the summer of 1875.

At the head of the Combe d' Arolla rises the grand mass of the Mount Colon, a truncate cone of precipitous rock, dominating the glaciers of Vuibez and Arolla, which, after sweeping down from the watershed of the Pennine chain, unite into one stream at its base. The highest point of its snowy cap is 12,264 feet above the sea. In the Swiss geological map the greater part of the mountain is coloured as gabbro, and the same rock forms a small peak near the head of the Otemma glacier on the S.W., and the S.W. flank of the Dents de Bertol to the N.E. The persistent bad weather prevented me from attempting the ascent of Mount Colon, or crossing the Col de Bertol, but I visited the only readily accessible place (on the N. bank of the Arolla glacier) where, according to the map, the gabbro can be seen *in situ*, in contact with the gneissoid rock, but here is either an error in the map, or (what is more probable) some change in the level of the glacier has covered up the junction. Hence my examination of the gabbro has been confined to the specimens which are brought down in great quantities by the Arolla glacier. Among these we find two types which we may call normal; one, a rather finely crystalline rock of a mottled dull bluish or brownish-grey colour, which consists of an apparently not very distinctly crystalline groundmass of felspar and rather altered olivine, in which are scattered numerous crystals, generally about $\frac{1}{5}''$ long, of a pyroxenic mineral, augite or diallage, of rather dull non-metallic lustre. The other variety is a coarsely crystalline rock, consisting of a dead-white or slightly greenish saussuritic mineral, and dark-green hornblende in prisms, often about $\frac{1}{2}''$ by $\frac{1}{8}''$. Still coarser varieties of the latter rock sometimes occur: and in these may be seen diallage crystals, an inch or so in diameter, which are in part converted into hornblende. Some-

* Min. Mag., vol. 1., p. 61, Feb., 1877.

times one of the diallage crystals is almost intact, sometimes it has an irregular border of hornblende, sometimes no trace of the diallage remains, the whole crystal consisting of the other mineral. The latter gabbro then illustrates the replacement of diallage by hornblende, so well shewn in some of the gabbros of the Lizard (Cornwall).* I have examined microscopically the two normal varieties noticed above. The first consists of plagioclase felspar in rather "stumpy" crystals or crystalline grains, fairly well preserved though in parts kaolinized,—probably labradorite; olivine generally well preserved, but here and there partly converted into serpentine; diallage with perhaps a little ordinary augite; and a few grains of iron peroxide. Besides these we notice an occasional brownish mineral, which generally occurs in irregular strips, often bordering a grain of olivine or diallage. It has an imperfect prismatic cleavage, a rather "satiny" aspect, is dichroic (pale yellowish-brown to darkish-brown), and closely resembles the mineral which I have described as occurring in a mass of rock included in serpentine north of Kynance Cove, Cornwall.† The cleavage is not characteristic, but I believe the mineral to be a variety of hornblende. Its occasional association with clotted ferruginous dust leads one to suspect it may be a secondary product, and its mode of occurrence suggests sometimes that it may be the result of an alteration of the diallage, in other places, however, it seems as if it were either wholly a separate mineral or formed from a separate crystal.‡ Possibly the composition of the original pyroxenic constituent of the rock may have varied slightly, so that one part would change more readily than another.

In the coarse variety of the Mount Colon gabbro the plagioclase is almost wholly converted into an aggregate of irregular microliths (bright coloured with crossing prisms) and dusky earthy clots. It is apparently identical with the mineral occurring in the altered gabbros of the Lizard district, being a kind of saussurite,‖ the result of the alteration of lab-

* See my paper, Quart. Journ. Geol. Soc., xxxiii, p. 895.

† Ibid., p. 889.

‡ The boundary between it and the diallage being sharply defined, or its being enclosed by grains of olivine or felspar.

‖ Analysed by Mr. Hudleston:—

Water (with traces of carbonic acid)	4·80
Silica	45·70
Alumina	23·00
Oxides of iron	·50
Lime	19·30
Magnesia	4·75
Alkali and loss	1·95
	100·00

Some of this magnesia may be due to minute fibrous hornblende which is probably present, but, as Mr. Hudleston observes, the result looks as if the original mineral had been anorthite.

radorite or anorthite. The hornblende occurs generally in groups of crystalline grains, sometimes shewing very characteristic cleavage, but being occasionally rather platy. Minute ferruginous microliths are not unfrequent. This mineral also closely resembles the hornblende described in a gabbro from the Balk (Cornwall).* I have not been able to detect any olivine or any considerable grains of serpentine; here and there, however, a grain seems to be composed of fibrous hornblende, mingled with ill-defined rather prismatic transparent microliths and an isotropic mineral, like some serpentines. This marked deficiency (even if the absence be not complete) of olivine or serpentine is to be observed in some of the Lizard gabbros, and there I could only conclude that in certain cases the olivine originally present had not been converted into serpentine but had been replaced by hornblende. It is, however, very singular that a rock so rich in olivine as the first described, in which, also, the formation of serpentine is begun, should have lost all distinct traces of either mineral. This, however, is not without a parallel in the Crousa Down gabbro. It will be well for future wanderers in the less accessible districts about Mount Colon to keep a sharp look out in order to discover the relations of these two rocks, lest there should be, as at Coverack Cove, two distinct masses of gabbro. Be this, however, as it may, I have no doubt that the gabbro is a true igneous rock.

On the right bank of the Zmutt glacier, a gabbro similar to the above abounds among the blocks which are strewn thickly over the ice, and of course is found frequently in the bed of the Visp lower down. Here, also, as on the Colon glacier, both varieties may be found. The coarser one (saussurite and hornblende) shews occasional traces of the diallage; the finer hardly differs from that described above, and is evidently rich in olivine. I have not had sections made of these, as their similarity to the others is so great. This gabbro obviously comes from the Matterhorn; according to Sig. Giordano† it occurs *in situ* among the cliffs above, a little below the level of the Col de Lion, viz., about 11,000 feet above the sea. On the other side of this gap it is yet more largely developed, "Questo banco di roccia cristallina ha qui l' enorme potenza di 500 metri e soltanto cessa a 3580 metri d' altitudine." No trace, however, of gabbro, as I know myself, is seen on the opposite (eastern) flank of the mountain during the ascent from Zermatt. Sig. Giordano says of this "sul fianco orientale del picco a vece dell' eufotide non si trove che un gneis verdognolo-talcoso....Si ha qui pertanto il curiosissimo fatto del passaggio della eufotide allo gneis in un medesimo banco assai regolare." As, however,

* Quart. Journ. Geol. Soc., xxxiii, p. 895.

† Bulletino del Club Alpino Italiano 1868, p. 299.

there is no proof of this asserted passage beyond what can be seen from the Zmutt glacier more than 2000 feet below, and the rock is practically identical with that of Mont Colon, I have no doubt that it is really intrusive in the talcose schist. This, however, will be hard to prove by actual inspection, for the cliffs appear hopelessly inaccessible, and are frequently swept by showers of falling stones.

III.—*The County Geognosy and Mineralogy of Scotland.*

By Professor Heddle.

PREFACE.

THE chapters of this work purport to be chronicles of the present state of our knowledge of the mineralogy of the northern portion of the kingdom The geognosy and lithology are treated of to such an extent only as, in the first place, to explain the position of the minerals; and, in the second, to aid future investigators in their explorations.

In these chapters, in order to do full justice to the work of others, the authority for, and the original discoverer of every locality mentioned, will be quoted, wherever known.

The author, having attempted to visit every known mineral locality to the north of the Forth and Clyde, and having succeeded in this attempt with less than half-a-dozen exceptions, is able in most cases to authenticate, or the opposite, as the case may be, the statements of previous observers.

When no remark is made upon the statements of others, the author is to be understood as himself vouching for their accuracy; when the locality was thoroughly well searched, but unsuccessfully, the letters *n.f.* for *not found* are appended; when there seemed to be sufficient ground to believe any previous statement to be erroneous, the letter *d.* for *doubtful* is superadded.

This record is the result of some five-and-twenty summers of persistent exploration, and of many winters of equally persistent analytical research. In the hope that it may serve as a mineralogical guide book, the localities are given with a fulness of description, and precision of detail which aims at leading the collector, if not to the spot itself, at least to within half-a-mile of it.

As there is no school for the study of mineralogy like that of nature, the study of a chronicle of the *natural occurrences* of minerals should be the next best mode of gaining acquaintance with them.

The precise amount of value, as a piece of scientific information, which is conveyed by such statements as that "*andalusite was formerly found in*

the county of Aberdeen," or to amplify, by one step, that "*Babingtonite occurs in white quartz in one of the Shetlands*," it would be difficult to estimate; as it is to estimate the exact amount of the boon conferred upon mankind by the purchase, at fabulous prices, of loose specimens from too frequently falsified localities;—said specimens being forthwith secreted in locked cases, till the purchase of the next "curiously rare" substance momentarily exposes them to view.

If the tenth part of the money which is thrown away,—the word is used purposely,—upon the rivalrous hoarding up of specimens, were expended in individual exploration of different parts of the country, followed up by judicious and well directed analytical investigation of rocks, and of alteration products, the following results would probably be attained.—

Geologists would no longer characterise mineralogy as being a repulsive study, inasmuch as it was but the "dry bones of a science," destitute even of the lineaments of life. Mineralogists would no longer speak of the false application of the word *science* to that which, founded not on *known* laws, was speculative and theoretical,—propped on the one side by false chemistry, and on the other by unsound physics.

Museums in the country would become more numerous; and the present rivalry of secretiveness would give place to a rivalry in the sending the best, or at least the second best specimens to one or other of the three metropolitan museums,—such being the only sure way of attaining to anything worthy of being called truly national collections.

Probably the most scientific manner of treating of the mineralogy of a county would be to commence with the consideration of the minerals occurring in the oldest rock,—working from that gradually upward.

Inasmuch, however, as such a plan would be difficult of execution from the older rocks occurring in several counties, I shall adopt the simpler one of locality; taking the counties in order of their occurrence from north to south.

The geological guide maps are, for the sake of uniformity, coloured in conformity with the tints adopted in the maps of the geological survey; with the exception of *yellow*, which is used for quartzite, that serving as a guide rock in many localities. An index of the colours and signs, taken for the most part from Professor Geikie's Geological Map of Scotland,* is appended in most cases. Mineral localities are in these maps indicated by a ring O. The maps, it must be observed, are on very different scales.

* To this map the reader is referred for full information as to the signs adopted.

As it is not practicable to collect minerals in Shetland and the Western Islands with either success or comfort, in any other way than by taking a yacht as a travelling habitation, and attacking the rocks by blasting, or the employment of heavy tools, some useful information is conveyed in the maps of insular localities, as regards anchorages and dangerous rocks.

When an anchor is laid down, it is intended to be implied that a craft can safely lie in all circumstances, unless when otherwise stated. The soundings indicate the proper course out of a harbour; the shallowest points on either side of the channel being also laid down. Rocks which require to be given a wide berth are marked with a cross. Where a passage is *practicable*, but should only be made use of under the guidance of a local pilot, it is pointed out by a curved line. Where merely *a grapline* is laid down, it is meant to be implied that there is safety only with the wind in the direction in which the grapline lies; and that if it is purposed to lie there for the night, that should only be done with ample preparedness for an immediate start, on a shift of wind,—an anchor-watch being in such situations imperatively necessary.

ABBREVIATIONS.

A.	Allan, Robert or Thomas.
C.	Cunninghame, R. J. H.
D.	Dudgeon, Patrick.
F.	Fleming, The Rev. John.
G. & L.	Greg and Lettsom.
H.	Heddle.
Hb.	Hibbert, Samuel.
J.	Jameson, Robert.
Mc C.	Mc Culloch, John.
N.	Nicol, James.
T.	Traill, Thomas Stuart.
Ukn.	Unknown.
Trv. Gui.	Travellers' Guide through Scotland; the mineralogical notices in which were written by the late John Watson, Esq.

ORKNEY AND SHETLAND.

ISLAND OF UNST.

Geognostic features.

IT would have been well if the consideration of the geognostic features of Unst had gone along with that of the adjacent island of Fetlar, inasmuch as the strata met with in Unst are but the more widely spread developments of those which are to be seen, in more condensed form, in the latter island. The size of page, however, not permitting of a map which on a useful scale of projection would admit both, the more northerly island must stand alone.

Unst is entirely composed of that class of metamorphic rocks which, at present, are referred to the lower-silurian epoch.

The metamorphism is of two degrees, or stages:—that primary, or more purely *physical* metamorphism, which produced arenaceous gneissoid rocks, quartzites, micaceous schists, and crystalline gabbros;—and that secondary, or *chemical* transmutation, which converted the more schistose varieties of the former into talcose and chloritic schists; and the crystalline gabbros into serpentine and limestone.

As is usual throughout the other parts of Shetland, and of Scotland, the earlier formed of these rocks lie to the westward; and, as elsewhere in Scotland, the general strike has a north-east and south-west direction; though in Shetland it has less of an east and west tendency than that normal to the rest of the country.

As the general dip of the gneissose rocks of Shetland is to the west, it would appear that it represents the ascending curve of one of the folds into which that rock is thrown, as it passes eastward from its first normal dip. At no great distance in Yell the westerly fall is prevalent; and as in Unst we have, within a short space, a succession of westerly and easterly dips, followed by a decided and terminal fall in the latter direction, it would appear that within the island we have a crumpled anticline; and this is immediately succeeded by the superposition of a rock which is a more recent variety of the same general series.

It is a somewhat constant feature of the gneiss of Shetland that it is abnormally deficient in felspar; composed thus chiefly of two substances which are almost unalterable under the ordinary agents of exposure, it possesses the character of unusual durability.

It is due doubtless to this fact, taken in conjunction with the direction of the strike, that it forms the enduring backbone of the group of islands; giving to them dimensions which are greater in a north and south direction, than those at right angles thereto; and forming for some of them a protecting buttress against the western ocean. At first sight this may seem to be due merely to the amount of submergence; it resolves itself into the same thing in the end, being but a question as to what kind of rock has resisted longest the various processes of denudation, and the different agents of decay.

There is no county in Scotland which presents us with so many varieties of rock as Shetland; and there is no one of the islands which has so many of these equally condensed in space as Unst; and, as the points of junction of different strata are one of the richest fields for minerals, Unst, therefore, should yield these abundantly.

The geographical configuration of the island of Unst is,—a sea board on the west, which, in a general sense, is a straight line;—a deep and direct central trough;—and a markedly indented and undulating sea board on the east. On the north and south the sea finds its way, as deep "Voes," far inland; running up the great central depression. All of these features are immediately dependent upon its geological conformation.

In the more southerly main-island we find, interstratified with the gneiss, three great beds of limestone. Here, as elsewhere, these beds, through aerial waste, form trough-shaped hollows among the more enduring strata; and in insular positions their washed out terminations are represented by bays which thrust themselves far inland.

The most easterly of these limestone beds occurs, in the mainland, to the eastward of all the gneiss; lying between it and the mica schist. The undoubted representative of this bed occurs in Unst in a precisely similar position, forming the great central trough; this is cut out here and again into narrow lakes; and forms, as its northern continuation, the deep and lengthy arm of the sea called Burra-Fiord.

There is every reason to believe that the straight and precipitous line of western cliffs have been formed by the washing away of the prolongation of the central of these lime strata; for, in the projecting westerly promontory of Houlan Ness, limestone is still to be found,—a prolongation of which, north and south, would exactly skirt the coast.

It is a peculiarity of all the formations of the larger, or mainland of Shetland, that, after a general north and south strike maintained for many miles, they gradually uniformly sweep round to the eastward in their outgoings. This same feature is to be observed in the rocks of Unst; and the deep bays on the eastern coast are found to occur either at the junctions, —the weak points—of the strata, which have curved round so as to meet that coast at an angle,—or in the hollows between the hill ranges of these strata.

Thus the most northerly of these bays—Norwick—lies in the junction between the mica schist and the serpentine; Haroldswick, between two hill ranges of the serpentine; Balta Sound is formed partly in this latter manner, partly by the junction between the serpentine and the diallage; a continuation of which junction line severs the island of Balta from Swinaness; and lastly, the Bay of Vere lies in the hollow between the gabbro and a series of strata, of which a chloritic slate is perhaps the most prevalent.

There is a rock, the relationships of which are obscure, which has not yet been noticed. It presents itself in but small extent in the south-west corner, forming a precipitous headland. The peculiar colour of this rock has given the name to this headland, the *Blue Mull*. A rock—indeed a Mull—very similar to, though on a grander scale than this, also occurs in the south-westerly corner of the mainland, forming the Fitfel Head.

There has been considerable discussion as to the nature of this rock, —certain geologists calling it mica slate,—others clay slate. Cornish miners termed it killas; Hibbert speaks of its unctuosity, inclining to consider it talc slate.

Hibbert correctly noted its easterly dip at the Fitfel Head; but considered it as merely a detached portion of the clay-slate, which extends from Quendal Bay to Deal, though he assigns to the general mass of that rock a westerly dip.

I have to remark in the first place, with regard to the dip of the clay slate of Shetland, that I believe Hibbert has, in many places, mistaken *cleavage* for dip; and in the second, that I was unable to find in the great mass of the clay-slate, the peculiar features of the Blue Mull and Fitfel rock. The relationships of the Fitfel mass to the other rocks of the district cannot be well made out; as it is cut off, in the first place, by a granitic intrusive rock; and the first true clay slate to the east is, for many miles, covered with a great deposit of shifting sand.

The Blue Mull rock dips generally to the east, and seemed to me to abut against the gneiss, through a fault; but I was unable, on account of surf, to reach the actual junction.

A rock which possesses the mingled features of mica, clay, and talcose schist, describes itself, so far at least as to render further description difficult except to say that it has a light blue color, glistens with minute scales of mica, and that it appears to have an argillaceous basis. I should describe it as very unlike mica slate; and as tending *in appearance* most to a talcose slate. But it is so similar to, though it may be said to be an extreme development of a rock occurring nearer home, so to say, that further description may not be called for. The rock I refer to also has led to a hesitancy in its describers; it occurs, ill-developed, in Glen Rinnes; well-developed, though not by any means so strikingly so as in Shetland; in the parish of Boharmin Bauff; in Glen Mid Clova, and the Coreen Hills, in Aberdeenshire. At the two latter localities it is studded with crystals of andalusite. Of the basis, perhaps a tenth part was found to consist of a mixture of minute garnets and magnetite; while the remainder was found on analysis to be composed wholly of minute scales of *pihlite*. I incline to believe that the Blue Mull and Fitfel rock will prove to consist largely of this, or a somewhat similar substance.

The Glen Rinnes rock occurs far west, that is low down in the gneissose series of Banffshire: I was never myself able to find its actual contact with the more easterly quartzite; but its dip is certainly to the east, and Hay Cuninghame states that he has actually seen it dipping under the quartzite, to the south of Tomantoul.

If this be a rock *sui generis*, its position so low down in the gneissose series might have no further interest than that attaching to a new member of that series; but, as *the* rock which in Scotland carries andalusite, staurolite, and some other substances it is worthy of a special investigation.

The gneiss of Unst forms a somewhat uniform belt of about 11 miles in length, by 2 in width, consisting of a hilly ridge running north and south, and forming a cliffy bulwark against the western ocean. This seems never to repose peacefully at its feet, but to be unceasingly seathing and grinding among the rocks of a shore, which, for ruggedness and absolute repulsiveness of appearance, can have few equals.

To the east the gneiss falls into a valley, which is somewhat monotonous, from the too frequent repetition of the lakes which, in a somewhat swampy manner, fill its hollows, or represent the former outcrops of its limestone. A continuous mass of the latter lines the eastern shore of the Loch of Cliff, for a distance of about three miles. Underlying this line at its northerly extremity, on the shores of Burra Voe, there is a small patch of a rock regarded by Hibbert as quartzite; probably more correctly an unusually quartzose mica schist.

To the eastward of the lime, or of the "lime sinks" in the valley, there are thin and mostly concealed beds of chloritic and micaceous schist; which latter suddenly expands greatly in thickness,—rises into a hill nearly 1000 feet in height,—and curves round to the eastward, forming the bluffy headlands of the whole north of the island.

This again is one of those rocks of an intermediate nature. It is of a very close and fine grain; and the mica seems to be nearly as small in the particles, and in almost as granular a condition as the quartz. The mica is sometimes also very small in quantity, the rock assuming the character of a sandy grit. Hibbert found much magnetic disturbance at the top of the hill, while the magnet of the writer was unconscious of any disturbance; nor was any cause thereof to be found, for the few exposed stones on the hill top carried minute garnets, and no visible magnetite.

The junction of the schists with serpentine appears at the head of the bay of Norwick, a little west of the small rock called the Ting of Norwick; it is not altogether well seen, being subject to be covered up by shifting sand; I incline to think that there must be a fault at the junction.

The serpentine which follows is of the dense massive uniformly coloured variety; that which also weathers with a rusty crust. It does not here appear with the serrated peaks which are so characteristic of this rock in many districts; the whole of this side of the country presenting glaciated contours. As a serpentine, it is, from its dull colour and the total absence of variegation, devoid of beauty altogether; here and there small patches exhibit a rich deep green, and are translucent; but the uniformity of the tint precludes its application as an ornamental stone. It is also singularly deficient in veins of the precious variety; the few which occur will be mentioned among the minerals.

The serpentine is succeeded to the east by a ridged, if not a stratified gabbro, consisting solely;—so far as I know, of labradorite or an equivalent felspar, and augite.

The labradorite is an impalpable granular variety, containing some anorthite; the augite is of a light-green colour, tending towards diallage.

This gabbro is, in turn, succeeded by strata of a somewhat mixed nature; but, from its general prevalence, they may be grouped under the name of chlorite slate.

Skirting the south east shore, near the point of Muness, serpentinous rocks again curve in; these form the commencement of a rock much higher in the series than that already noticed; being the prolongation of the large mass which forms the Vord hill in Fetlar, and the Island of Haaf Grunay.

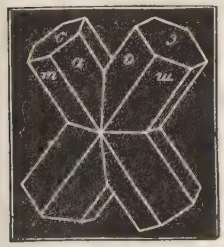
In the north-east corner of Unst there appears a rock of a nature intermediate between hornblendic-granite and syenite. It is markedly porphy-

ritic, containing very distinct crystals of felspar, one or two inches in length; these are embedded in a crystalline paste which shews hornblende and epidote.

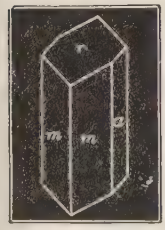
Minerals of the Gneiss.

A patch of this rock, lying between the south-end of the Loch of Cliff, and the rocky sea board in the vicinity of the little creek of Woodwick, approximates, to some slight extent, to the character of a mica-slate. Felspar is still present, but only in small amount; the rock, however, is unmistably gneiss.

Staurolite is found in this rock in three localities: on the sides of a little knoll which overhangs the sandy beach at Woodwick (Hb.); on the hill of Snuegar (H.); and near the summit, on the west side of the hill which lies between Woodwick and the Loch of Cliff (D. and H.)



The staurolite of this rock occurs only in minute crystals of about three-eighths of an inch in length; it is, however, of a rich-brown colour, and a high lustre. The forms are *m c*, *m c a*, *m c a r*, this last is the Saint Andrew's cross twin; and *m a r*, with the last face hemihedral as in figure. As the crystals which have been exposed by disintegration of the rock are those which are best seen, and, as this somewhat brittle mineral rapidly loses its terminations, the face *c* is but rarely present.



Kyanite is also to be found in association with the staurolite at the last mentioned locality (D. and H.) It there occurs in blue-grey radiating crystals of about one inch in length, which, instead of being as usual imbedded in quartz, form a band in the rock. *Magnetite* and *garnet* are here associates (D. and H.)

Minerals of the Mica Slate.

On the west side of the Hill of Saxavord, near its junction with the quartzite, Hibbert found *magnetite* in specimens of half the size of the hand.

At a spot called Urch near the west of Braewick, a little above where a small stream, the Ness-Muir burn, slides over the rocks, gold was said to have been found in decomposing slate, along with iserine. The story given in connection with its discovery is altogether incredible. Mr.

Dudgeon of Cargen, the author, and two of the so-called "most successful diggers" spent the greater part of a day in an absolutely unsuccesful search. The author afterwards found that, in the islands generally, the whole story was considered to be altogether unworthy of belief. The granular magnetic mineral which, in small quantity, is met with in washing the sands of the afore-mentioned stream, shows under the microscope of a pitchy blackness. The grains are but little attrited, bearing the impression of the quartzoze granules with which they are associated. They rarely show forms, these are certainly not octohedral, but apparently rhombohedral, with truncated angles. In all probability, therefore, they are *ilmenite*.

The quantity obtained, during the "gold washing" of four persons for a day, was about 3 grains in weight.

A black iron sand is somewhat sparingly found (D. and H.) among the ordinary silicious sands of the Dale burn, about the spot where it turns to the northward.

This proved on analysis to be a new chromiferous variety of *magnetite*. It is of a blue-black colour, decidedly but not strongly magnetic; under the microscope it seems much split or cleaved, of hackly fracture, and shows no forms. It was, as far as the small quantity obtained permitted, separated from silicious and non-magnetic sand, by repeated stirring up in water and decantation, and ultimately by the magnet.

When magnified, it then appeared to be, with the exception of an admixture of silicious grains, uniform.

On analysis it afforded :—

	1.		2.	
Ferric oxide	57·285	..	62·464	
Chromium sesqueoxide	9·4	..	10·25	
Ferrous oxide	24·944	..	27·199	
Manganous oxide	·4	..	·436	
Lime	1·12			
Silica	7·2			
	100·349		100·349	(H.)

2 gives the proportions, abstracting the silica and lime, as these are undoubtedly present from mere mechanical admixture.

The question is, can this be an admixture of magnetite with chromite? No one point connected with it favours such a view. Its geographical and geological position does not; it is found about two miles from the nearest chromite, with more than one hill ridge between; its altitude is greater than that of the chromite; and the stream which sweeps it from its parent rock, flows from a hill of mica schist.

It was physically purified by the magnet, which readily abstracted it from the silicious admixture: chromite is, at most, and that only rarely, feebly magnetic.

Its powder had a uniform blue-black colour; the crushed powder of chromite is brown.

Lastly, an admixture of chromite with magnetite would not yield the per-centages above given. The analysis points rather to a replacement of ferric oxide by chromic oxide, though it is not altogether accordant with that.

This magnetite was so difficult of decomposition, that comminution under water, with repeated decantation was had recourse to. Towards the conclusion of the process, the pestle was found to jump over a number of particles, which no force could reduce to powder, though several were found to be flattened out by the pressure into thin scales. These were thoroughly washed, and found to be strongly magnetic. When placed in an acidified solution of a copper-salt, they became instantly coated with the red metal. They readily dissolved in acid, without residue; and gave the tests for iron. In the pounding of the magnetite it had never been touched by an iron or steel tool; and, from the time when they were collected, to that in which they were examined, they were never out of the writer's possession; these grains, therefore, are *native iron*.

The occurrence of grains of this substance in a metamorphic rock is new,—frequent as is the occurrence in rocks of an igneous nature; and the occurrence of metallic iron in a rock primarily of a sedimentary nature is difficult to explain; but until a laminable magnetic substance, which precipitates a salt of copper, and gives the iron reactions, can be shown to be other than iron, this must stand for such. The grains had been protected from atmospheric action by a coating of magnetite,—a substance lately proposed and patented for this very purpose.

In the hill foot, about three-fourths of a mile to the north-west of the houses at the head of Norwick bay, there are several quartzose bands, running north and south; one of these carries pale blue rosettes of radiating *kyanite* (D. and H.)

A little to the east of the Bridge of Balliasta, in the more chloritic varieties of this rock, and near their junction with the limestone, there occurs a substance or combination, of a unique appearance; and one which is possessed of great peculiarity, if not beauty.

Upon a groundwork of a greenish yellow colour, and impalpable structure, there are sprinkled sparsely, or profusely,—as the case may be,—bright green crystals of hornblende of the size and form of ears of corn. (D. & H.)

It was the writer's fortune once to be acquainted with an individual who maintained that he had discovered *petrified maggots*. So marked was the resemblance to these here, that had the said individual seen these specimens, it would have proved no easy task to undeceive him.

The appearance of the cross fracture of this stone is very different from that of its more readily obtained cleavage.

It is seen to consist of successive layers of a foliaceous paste, each of which layers carries its sprinkling of hornblende crystals; the effect produced somewhat resembles an irregularly printed page.

When the stone is soaked in strong acid, the yellow paste darkens somewhat in colour, is loosened in structure,—swelling up,—and is seen by the aid of the lens, to consist of a multitude of minute crystals of talc.

Minerals of the Porphyritic Syenite.

This rock contains imbedded crystals of *orthoclase* of about two inches in size; these lie in a granular paste of felspar, quartz, hornblende, and perhaps epidote.

The rock is a very beautiful one, and might be utilized for ornamental purposes.

Minerals of the Serpentine.

Ting of Norwick.—This islet, connected with the land by a sand bank, is composed of junction rocks,—if I may coin a name for substances of an intermediate nature, which are difficult to specify. In old works this spot is indicated under the title of "Bay of Norwick," as the locality,—the only British locality,—for Breunnerite.

With difficulty a single specimen was obtained. This had a grey colour, and was in readily-cleavable crystals of an inch in size. The specific gravity was 2·91, the cleavage angle 106° 6′.

Its analysis yielded:—

Carbonate of Lime	.. ..	51·804
,, Magnesia	.. .. ..	37·998
,, Iron	.. ..	7·82
,, Manganese	.. ..	2·314
Quartz (insoluble)	.. ..	·02
		99·956 (H.)

This is *Ankerite*, and, so far as known to the author, the only locality of that mineral in Britain.

Along with the ankerite, there is to be found *talc* (D. and H.) of a yellow colour, and in a columnar form, suggesting pseudomorphism after kyanite.

Talc, in somewhat weathered specimens, is to be found in a vein which runs east and west about half a mile north-east of the houses at the head of Norwick Bay. Good specimens would doubtless be obtained by quarrying.

Quin Geo.—(New locality, D. and H.) This geo or bight is situated on the north-east of Norwick Bay. There are two geos, a north and a south: the ruins of a chapel indicate the spot.

From the north geo there were obtained, but only after a considerable amount of blasting, specimens of apple-green talc, perhaps finer than those procurable from any other locality.

The lustre and colour could not be surpassed in beauty. The associated minerals were dolomite, brounnerite, and jet black crystals of magnetite; as the dolomite was in highly translucent white crystals, the contrast with the talc was very beautiful.

The specific gravity of this talc is 2·76. Its analysis yielded:—

Silica	62·5
Alumina	·454
Ferrous oxide	·529
Nickel oxide	trace
Magnesia	31·842
Water	4·789
	100·114 (H.)

The *Dolomite*, mentioned as associated with this talc, occurred in primitive crystals of over an inch in size. The cleavage angle of these crystals is 106° 17′. The specific gravity, 2·865. Its analysis yielded:—

Carbonate of Lime	52·548
,, Magnesia	43·772
,, Iron	1·972
,, Manganese	1·369
Insoluble (talc)	·1
	99·76 (H.)

As has been mentioned, associated with the above, *Brounnerite* is to be found. It occurs in pale-brown rhombohedral crystals, not quite so large

as those of the Dolomite, in which, or in the talc, it is imbedded. Its specific gravity is 3·093; its cleavage angle 106° 50′. Its analysis yielded,

Carbonate of Magnesia	91·394
,, Iron	6·784
,, Manganese	·78
Silica	·6
Alumina	·136
Insoluble (talc)	·096
	99·76 (H.)

Of these three asssociated minerals, the talc usually occupies the position contiguous to the rock matrix.

Besides the above, there also occurs here *fibrous talc* (?) in veins of one and a half inches in thickness; the pseudo fibres being transverse to the vein: the mineral is white and silky.

Magnetite, rarely in jet black crystals of the form *o d*, of one fourth of an inch in size, a perfect polish, and consequent high lustre.

Brucite, in small specimens, rarely. These all occur in *North* Quin Geo.

In *South* Quin Geo there are to be found rolled pebbles of *serpentine* of the precious variety, containing imbedded pseudo crystals of diallage, which, though fully converted into serpentine, retain the foliaceous appearance of the former mineral. These "pebbles" are of but small size, rarely larger than an orange, but they are the finest ornamental serpentine to be found in Unst.

Hagdale.—This name is usually applied to the shoulders of a hill overlooking on either side the Bay of Haroldswick and Balta Sound. The *dale* opens into a small bight on the south side of Haroldswick; here *native copper*, and either *chrysocolla or malachite* was formerly found: the author was unsuccessful in finding more than indications of their occurrence.

On the shoulder between the hill of Heyoags and Keen Hill, a great quarry of *chromite* (Hb.) was formerly wrought. After sinking to a depth of about 86 feet the ore ceased; many thousand tons were here obtained.

It unquestionably, judging even from the appearances to be seen at the spot, formed part of a vein. This vein runs somewhat to the north of due east and west from the point where it is first seen, thus being nearly synchronous with the strike of the rock as shewn in the hill ranges. The vein does not everywhere carry ore,—that occurs only occasionally as "bunches." This vein has been wrought, here and there, along a stretch of perhaps a mile and a half; it throws one or two offsets, in the neighbourhood of the house of Buness.

The chromite is found extremely rarely in octahedra; these sometimes occur in the mass of the rock,—sometimes isolated and imbedded in a foliated soft green mineral (pennite?). At this quarry there were found the following minerals.

Emerald Nickel (H.) in fine specimens rarely, these generally pass into globular *Genthite* (H.) The emerald nickel is probably the result of the decomposition of minute specks of *Pentlandite* (H.) which are to be seen in the massive chromite. *Pennite* of a pale green rarely coats the shrinkage cracks of the chromite (H.)

Chrome Ochre (McC.) in bright yellow pulverulent layers, which shade off into green. *Arragonite* (H.) in radiating crystals, form *m a p x k v*, of half an inch to an inch in length. Massive granular *Kammererite* (H.) in considerable quantity, and rarely in hexagonal plates of a pale purple, passing into green. *Williamsonite* (H.) rarely. *Pennine* (D. and H.) in small but highly beautiful and perfect crystals *b o*, of an apple green colour, and a lustre nearly as high as that of talc. A foliated green mineral very similar to *grastite* is rarely imbedded in the chromite (H.)

There also occurs a scaly bronzy-brown substance, rarely coating cracks of the chromite; this I have not a sufficiency of for examination, and I can hardly hazard an opinion as to its nature. It may be a brown talc, or Biotite,— or a brown kakoxine, for it appears to be sub-fibrous.

The serpentine, when it approaches the chromite, and especially when it is intersticially lodged between the granules of that substance, usually assumes a lighter colour, passing at times into a bright yellow, and becoming denser and somewhat granular in structure.

A portion of this,—unusually pure, from being somewhat in the form of a vein,—for which I am indebted to the veteran meteorologist, Dr. Clouston, of Sandwick in Orkney, yielded on analysis,

Silica	31·854
Alumina	·988
Ferric oxide	7·464
Chrome oxide	3·073
Manganous oxide	·614
Lime	·631
Magnesia	37·09
Carbonic acid	1·178
Water	17·02
	99·912 (H.)

Granules of chromite were visible during the pounding of the mineral; while the analysis shews a mixture of magnesite. Deducting from the

above, proportional quantities of these, and again calculating to the same total, there is obtained,

Silica	34·461
Ferric oxide	6·757
Manganous oxide	·628
Lime	·585
Magnesia	38·961
Water	18·529
	99·912

This is evidently a serpentine, mixed with about 12 per cent. of Brucite; so that this yellow gangue cannot be considered as a simple mineral, but as merely a light coloured serpentine carrying Brucite, which latter has become somewhat carbonated. It is not usual for the iron to be in the ferric condition—but we have analyses giving it as such.

The massive Kammererite is granular to foliaceous; it has occasionally nodules the size of shot, which are quite granular, and may be different in composition. Its colour is pale purple to bluish purple. Rarely, imbedded hexagonal foliated plates are to be seen. The foliæ split across the crystals, which are less than the quarter of an inch in diameter. The specific gravity is 3·099. The analysis yielded,

Silica	29·894
Alumina	12·931
Sesqueoxide of chromium	5·967
Ferrous oxide	1·955
Nickel oxide	tr.
Lime	3·54
Magnesia	29·933
Potash	1·156
Soda	·974
Water	13·266
Carbonic acid	tr.
	99·616 (H.)

I also found, imbedded in the purple Kammererite, in patches about the size of beans, a substance which I believe to be new. As I have not yet obtained a sufficiency of this substance in a perfectly pure state for a thorough investigation, the following notice of it must be considered as merely preliminary.

It occurs as a loose powder of a fine lemon yellow colour, which contrasts beautifully with the purple of its matrix.

In endeavouring to obtain enough for analysis, a portion of that matrix was unavoidably scraped off along with the powder.

This matrix, being Kammererite, was insoluble in weak acid. The yellow powder, which was freely soluble, consisted solely of carbonates of lime, iron, and manganese, a trace of chromium, magnesia, and water. It lost in the water-bath 1·006 per cent. of moisture. Its analysis yielded,

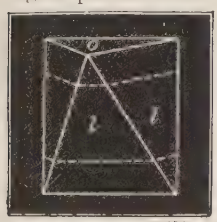
Lime	22·57	
Ferrous oxide	2·561	
Manganous oxide	·461	
Chromium oxide	trace	
Magnesia	21·059	
Carbonic acid	20·177	
Water	12·478	
Insoluble (*Kammererite*)		20·678
	79·306	(H.)

This, made up to 100 parts, gives,

Lime	28·459		29·94
Ferrous oxide	3·229	30·366	
Manganous oxide	·583		
Magnesia	26·554		32·09
Carbonic acid	25·442		23·53
Water	15·733		14·44

This evidently does not come under the formula of any known mineral: it may point to the formula 2 CaO, CO_2 + 3 (MgO, H_2O),—the per-centages of which are given in the second column. Should the analysis of purer specimens prove it to be a distinct substance, I would propose to name it *Hibbertite*, after the discoverer of Chromite in Unst.

The more recently opened quarries above Buness have yielded finer and larger specimens of the same substance, in the same association. Also



Kammererite (D. and H.) in fairly well pronounced crystals, of the form depicted; these are nearly half an inch in length. The foliæ are hardly thin enough to show the optical properties well, but it is uni-axial, or if bi-axial, the divergence is very small. The colour is a fine rose purple. Its analysis afforded,

Silica	32·307	
Alumina	7·497	
Lime	3·833	
Chromium Sesquioxide	7·888	
Ferrous oxide	2·076	
Magnesia	32·153	
Water	14·246	
	99·9	(H.)

A specimen of what was thought the richest chromite from this quarry was analysed. It was a very crystalline mass, almost in isolated octohedra; the crystals were separated from each other by foliated pennite. (?) These crystals were jet black and of high lustre. After most careful picking, small grains of translucent quartz were still visible; the quartz seems to occur only in the interstices of the chromite. This certainly is a singular fact. I have never been able to find any quartz imbedded in the serpentine.* There was obtained,

Ferrous oxide	17·519=19·465	Fe_2O_3
Manganous oxide	·499	
Chromium Sesquioxide	44·555	
Lime	1·286	
Alumina	23·741	
Silica	11·088	
	98·688	(H.)

In accordance with the usually received view, I have tabulated the iron as protoxide; but by no method of decomposition could I obtain it except as sesquioxide; even the process which I have given for the determination of ferrous oxide,—which decomposed the mineral with extreme difficulty,—yielded the iron as ferric oxide.

It has to be remarked also, that in the later analyses by Starr, and by Garrett, they give the iron as present in the state of ferric oxide; and that in the analysis of the light yellow serpentine from Hagdale, which was stated above to contain chromite, no protoxide of iron was found.

I am well aware how repulsive such a fact must be to the theory of isomorphism: I can only state what I got, and say that I do not see how any peroxidation could have occurred; and that I cannot otherwise explain the large loss.

Arragonite occurs not unfrequently, coating this chromite. The yellow serpentine is here the vein stone (D. and H).

Swinaness.—As we approach this point, the serpentine gradually becomes less massive, and altogether less uniform in structure: a certain amount of rough bedding, or lamination parallel to the line of its junction with the adjacent gabbro, is also occasionally visible. The actual junction with the latter rock is nowhere, on the north side of Balta Sound, to be seen; the North Channel, or northern entrance to the Sound occupying the junction.

* My assistant, Mr. John Dalziel, tells me that two specimens of chromite which he analysed contained about 20 per cent. of silica.

Along the line of hollows which represent the junctions of the beddings of the altered rock, exfiltration veins are to be seen. These generally are of calcite, occasionally crystallized in "nail-head," and other common forms. One of these veins contains *Brucite* (Hb.), which occurs in large foliaceous sheets, and also in botryoidal masses (H.) The latter mode of occurrence I believed to be unknown elsewhere. The curvilinear outline lies at right angles to the sides of the vein, which is about one and a half inches wide. The rounded forms are composed of successive layers of the mineral, which also shows somewhat of a columnar or rudely fibrous structure, at right angles to the lines of separation of the layers. The mineral very rarely shows the outlines of superimposed hexagonal crystals. It seems here to lose water on exposure, more rapidly than it becomes carbonated; for I have found that specimens which had become dull and somewhat earthy looking, had their brilliancy restored by being plunged in water. And this restored brilliancy they have not again lost.

We have the following old analyses of the Brucite of Swinaness, and I add one of the foliated variety.

$\dot{M}g.$	$\dot{F}e.$	$\dot{M}n.$	$\dot{C}u.$	$\dot{H}_2.\ddot{C}.$	
69·75	..	..	..	30·25=100	Fyfe
67·98	1·57		..	30·96=100 51	Thomson
66·67	1·18	1·57	·19	30·39=100	Stromeyer
67·987	4·13	3·06	tr.	30·995=99·701	H.

Loses, ·188 p.c. in water-bath.

Even the most transparent specimens effervesce slightly in acid. The specific gravity of the foliated variety is 2·336, of the botryoidal, 2·37.

The foliated variety occasionally exhibits a parallel lineation; this represents the edges of crystals which are greatly prolonged in a direction transverse to the main axis.

The botryoidal variety sometimes appears to result from the superposition of piles of crystals, as in globular mica.

A brown powder occurs very rarely in cavities of the Brucite, and,—imbedded on this,—minute highly lustrous crystals of the extremely rare *hydro-magnesite* occur (H.)

The same substance, in an earthy form, coats Brucite, and seems to impregnate nail-head calcite (form *e b*), rendering it dull and chalky. I have not found the quantity of magnesia in these crystals to be constant. About the centre of the Ness a vein of pale green serpentine carries finely developed rhombic-dodecahedral striated crystals of *magnetite* (H.)

A vein of what may be called *precious serpentine* is to be found at this spot (Hb.) It consists of a matrix of rich dark green oily looking serpentine, studded with pseudomorphosed, dull, light green crystals of

foliaceous diallage. It is sufficiently ornamental for the fashioning of letter-weights, and small articles which do not require a large, or boldly-diversified pattern, or a striking contrast of colour.

Asbestus, of a dark green colour,—and specimens approaching in character to *mountain wood* occur among the rocks on the south shore of the Ness. (D. and H.)

It has been said that here the character of the rock manifestly approaches to that of gabbro: there are few spots where the *latter stages* of the transition of gabbro into serpentine can be better studied than here. In a little inlet on the north-east shore, the passage may be seen almost in hand specimens. Some of these, besides the ordinary transmuted diallage, contain a transparent smaragdite-green highly lustrous substance, in fissured crystals, this I believe to be *diaclasite*.* This has apparently suffered no change whatever; and I have elsewhere found that, in an association of diallage with this mineral, the former is sometimes perfectly changed into serpentine, while the latter has suffered almost no transformation.

Along with this diaclasite there occurs *amianthus* in interlacing fibres of a blue grey colour (D. and H.) This has been by Hibbert mistaken for hypersthene.

Minerals of the Gabbro.

The great mass of the gabbro of Unst consists of an admixture of minute crystals of diallage, and of a labradoric mineral, which would generally receive the name of "Saussurite."

So crypto-crystalline is the structure of this gabbro that, were it not for the ridged nature of its hills, it might, in the larger island, be considered to be of an igneous nature.

An inspection of the rock in the islands of Balta and Hunie conclusively, I believe, negatives such a view. Here and there, in the few places in which the rock is exposed in Unst, its laminated structure is disclosed by a parallel banding imparted to it by the segregation of layers or lines of more amply developed crystals of its two component minerals; but it is only in the above smaller islands that this is seen in its most pronounced development. So marked and sudden indeed is the appearance of belts of giant crystals of the diallage, that the high tilted beds are, at first sight, set down as exfiltration veins.

Two of these pseudo-veins are admirably exposed on the south side of a geo, which faces a ruined Brough (H.) Protruding through the turf, they form two easily discerned ridges, which strike north-east, and are cut off by the cliff of the south side of the sea-hewn geo.

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* Circumstances prevented me from getting a sufficiency of this for analysis. I recommend it as worthy thereof to those who may have the opportunity of so doing.

Both of these enduring beds are striking objects:—both consist of a granular matrix of white or pale blue felspar. In the one, this matrix is studded with large dark green platey crystals of hornblende, of half the dimensions of the palm of the hand; the second is similarly studded with equally large foliaceous crystals of light green diallage.

The felspar which carries the hornblende is lavendar blue; that carrying the diallage is opaque white.

These belts are within a few feet of each other; and, in the occurrence of the two minerals in the same rock,—in the same matrix,—and in such close contiguity, we have the strongest conceivable argument,—were such now necessary,—against the view which regards augite as the igneous representative of hornblende.

As so crucial an illustration of the fallacy of such a view is perhaps unique, the minerals of both veins were analysed.

The lavendar blue felspar, associated with the hornblende, was occasionally white on its surface. Its specific gravity was 2·95. Both it and that associated with the diallage were so minutely granular as to show no structure to the lens. It contained,

Silica	52·212
Alumina	29·64
Ferric oxide	·48
Magnesia	·263
Lime	12·428
Potash	·443
Soda	3·998
Water	·111
	99·575 (H.)

That which was associated with the diallage had a specific gravity of 2·954. It contained,

Silica	53·136
Alumina	29·992
Ferric oxide	·248
Magnesia	·208
Lime	12·296
Potash	·472
Soda	3·86
Water	·21
	100·422 (H.)

The two minerals are evidently the same. But what mineral is it? These analyses accord admirably with the composition of labradorite, but the gravity is somewhat high. To leave no room for doubt, especially as the mineral would, if not absolutely determined, be classed as Saussurite, slices were examined by the microscope. It was found to consist of a general mass of a delicately striated felspar, sprinkled here and there with patches of a minutely granular substance; and this last was identical in appearance with the anorthite, which occurs in the adjacent island of Fetlar. The high gravity is therefore due to this admixture of anorthite.

There may be some question as to the particular plagioclastic felspar with which it is mixed; but although the deviation from the composition of typical labradorite is perhaps not so great as the amount of admixture visible in the microscope would lead us to expect, yet the composition is not at all what such an admixture with *oligoclase* would afford; and as there are no grounds for supposing the presence of andesine, I do not hesitate to consider the general mass of the substance to be labradorite.

As the result of simple inspection, this mineral would have been pronounced *Saussurite;*—as the result of analysis it would have been declared *labradorite;*—as the result of microscopic inspection, aided by analysis, it is declared to contain a quantity of *anorthite*, mixed with a larger quantity of a plagioclastic felspar,—probably labradorite: so we are left in the position of earnestly desiderating some optical test for the discrimination of the various plagioclastic felspars, especially when they are in a cryptocrystalline form.

The hornblende from this locality is in large, dark-green, dull, somewhat foliated crystals; these show their rifts filled with calcite, probably from incipient alteration. Its specific gravity is 3·112; its cleavage angle 124° 27′. It contained,

Silica	45·866
Alumnia	8·779
Ferrous Oxide	14·151
Manganous Oxide	·133
Lime	9·818
Magnesia	14.4
Potash	·821
Soda	1·43
Water	2·301
Carbonic Acid	not det.
	97·699 (H.)

The very fine diallage of the second vein is of a grass-green colour; its structure is foliated; it has not so much of the pseudo-metallic lustre as is generally seen in this variety of augite. Its specific gravity is 2·965. It contains,

Silica	50·233
Alumina	5·845
Ferrous Oxide	5·223
Lime	11·23
Magnesia	21·586
Potash	1·199
Soda	·582
Water	4·167
	100·074 (H.)

It is the general rule that when hornblende and augite are associated in a rock which is showing an incipient serpentinous change, the augite is markedly more prone to that change than the hornblende: it is here the opposite; the thin rifts of calcite in the hornblende proved its alteration, while the diallage is apparently unaltered.

The eastern coast of Balta is suffering much from the assaults of the waves, being cut into deep "geos," one of which threatens to separate the island into two, to the serious detriment of the excellent roadstead of which it is the breakwater.

In one of these geos the officers of the survey found a vein of amianthus, of unusual, if not unrivalled excellence. The length of the fibres is but small, being seldom over four inches, never over a foot. It is, in mass, of an olive-green colour. Its excellence lies not so much in the flexibility of the fibres,—for they are of such extreme tenuity as to be brittle, which is a detriment to their application to certain of the purposes to which this substance is put,—but in their extreme softness, and freedom from impurity. With very slight pressure between the fingers, in which they are almost impalpable, they can be rubbed down to a pulp, which has all the unctuosity, and far more softness than that of French chalk. As a lubricant, the mineral from this locality would be of high value.

The collector must descend between the walls of the geo, keep on the parapet which winds along its south side, and turn the corner of the cliff southwards, gaining a platform on the eastern side,—this is the site of the vein.

The specific gravity of this amianthus is 2·949. It contains,

Silica	56·153
Alumina	1·539
Ferric Oxide	·388
Ferrous Oxide	3·111
Manganous Oxide	·769
Lime	11·716
Magnesia	22·461
Potash	·188
Soda	·692
Water and Fluorine	2·5
	99·517 (H.)

In close association with this amianthus, the writer found a most peculiar variety of the same substance: so different in appearance in most respects, that it must be regarded as an allomorph.

It occurs in a layer immediately in contact with the amianthus; the layer being about a couple of inches in thickness.

Its appearance is that of a fissile schist, which may readily be split up into laminæ of extreme thinness. Its colour is a pale pea-green; it is translucent in thin fragments, and altogether so similar in appearance to *antigorite*, that it was, without hesitation, regarded as that mineral.

Being of extreme toughness, and naturally splitting into axe-shaped fragments, it would, by Dana, be classed as *nephrite;* and, in composition, it would stand immediately central in his list of analyses of that substance.

It is altogether dissimilar to the amianthus with which it is associated; but its most remarkable peculiarity is, that where it is exposed to the air, it passes into it:—the amianthus appearing to *grow* out of the solid and fissile stone.

Moreover, although this stone may be scraped down into powder by the knife, like steatite or slate pencil, yet if it be crushed or beaten in a mortar, it is immediately matted into a felt of amianthoid fibres.

The laminæ of this stone have a rough cleavage in two other directions, forming angles somewhat near those of hornblende.

Its powder and cut surfaces are both very smooth. Its specific gravity is 2·957. It contains,

Silica	55·734
Alumina	·045
Ferrous Oxide	5·203
Manganous Oxide	·008
Lime	13·241
Magnesia	22·696
Potash	·138
Soda	1·12
Water	2·438
	100·625 (H.)

In the main passage of this geo there are to be obtained most interesting specimens, which show, when analysed, the gradual passage of asbestus into serpentine.

The mineral occurs in veins (H.): there is not in the specimens any appearance of change; they are quite unweathered, quite fresh, and to all appearance undergoing no alteration, except in this, that the comparison of different specimens shows a gradual fading of the characteristic appearances of the one mineral, and a gradual assumption of the features of the other; and, secondly, that in the specimens in which the latter is well marked, there is generally more or less fibrous calcite lodging between the filaments of the mineral.

As a general description of these, they may be said to occur in dark-green, finely fibrous masses, of a greasy lustre, and unctuous feeling: but it would be difficult to pronounce whether they were asbestus or picrolite.

A specimen presenting the extreme of each appearance was analysed; the second specimen was more lustrous, more serpentinous, and somewhat less fibrous.

The specific gravity of the first was 2·693; of the second 2·634.

	1ST.	2ND.	
Silica	50·193	50·076	
Alumina	2·099	1·876	
Ferrous Oxide	4·393	6·087	
Manganous Oxide	·007	·23	
Lime	5·067	·86	
Magnesia	29·226	31·566	
Soda	·743	·341	
Water	8·5	9·302	
	100·228	100·342	(H.)

The mode of the change of *asbestus* into *serpentine* here shown is, a gradual increment of water,—a gradual decrement of lime, and partially of the other bases,—but as yet no decrement of silica.

There is, as the result of the above, the *apparent* increment of magnesia; but this is, in reality, merely a *proportional* increment, not an actual insertion. This change is probably the result of the direct action of carbonated waters.

At the Cleft-geo, to the south of the last, diallage, similar to that of Brough geo, but in still larger specimens, is to be found (D. and H.); they are perhaps the finest to be obtained in Scotland; their matrix is again the white labradorite.

The Great-geo affords a fast disappearing vein (?) and numerous loose blocks of granular and translucent quartz, carrying imbedded crystals of *epidote* of half an inch or more in size, and of a fine green colour (D. and H.) This occurrence is doubly anomalous:—first as regards the presence of quartz in gabbro; and secondly, as regards the occurrence of epidote without hornblende,—of which mineral it is commonly regarded as an alteration product. So far as Scotland is concerned, I am prepared to combat such a view, and this very case aids me in the so doing. There is no hornblende in the vicinity; and the perfectly fresh epidote is in fairly well-developed crystals, which impress their form on the inclosing quartz. They are isolated crystals, and must have crystallized out of a paste of the quartz. It is more than difficult to conceive any formation from hornblende in such circumstances.

This epidote contains,

Silica	38·753
Alumina	26·986
Ferric Oxide	7·898
Ferrous Oxide	1·806
Manganous Oxide	·501
Lime	20·378
Magnesia,	·786
Potash	·25
Soda	·21
Water	2·376
	99·944 (H.)

By turning the point of a tongue of land, or rather cliff in the Muckle Head Geo, a vein of *amianthus* of considerable bulk, lying at the very foot of the first step of the cliff, may be seen (H.) It is of much the same nature, but inferior in colour to that noticed from Doos' Geo. Amianthus

is also found in small quantities at a point marked on the chart, on the east side of the island.

A small indentation in the shore cliffs at the south end of the island, is, at its termination, blocked up by what appears to be a decomposing vein of yellowish-white clay,—perhaps kaolin, from felspar; if so, it may be worth looking after, as the quantity is large. In this, the writer got a single finely formed crystal of *Muscovite*, of a very brilliant yellow colour.

In several points of the east shore of the island of Hunie, diallage and labradorite, similar to that of Balta, are to be found. It is generally the case that any substances which occur in minute proportions throughout the general mass of a rock, crystallize in readily determinable forms in the exfiltration veins or belts of giant crystals, should such occur; but in neither Balta nor Hunie have I found, along with the larger masses of diallage, any other substance imbedded in the felspar;—except a very occasional trace of *Chlorite*.

A small creek between the harbour of Muness and the bay of Sandwick, lies in a Chlorite slate, which is so impregnated with granular pyrites (Hb.) as to give to the locality the name of the Golden Geo.

Reviews and Notices.

Chapters on the Mineralogy of Scotland, by M. Forster Heddle, M.D.
Chapter II.—*The Felspars.*

FEW modern papers on Mineralogy, either in general interest, or in the amount of detailed labour, equal this elaborate Memoir—which was presented to the Royal Society of Edinburgh, in 1877.

The author commences with some general remarks upon the method of analysis employed, remarking with regard to the Silica determinations, "We cannot hope to execute correct analyses of Silicates until we employ vessels of a material other than glass."

Then follows an enquiry into the condition of the Silica in minerals, where the author finds the proportions of "insoluble" Silica to vary in orthoclase from different districts, from ·027 p.c. up to 18·62 p.c., —*i.e* of the silica itself—while even in specimens of the *same* mineral from the *same* locality differences as great as 2 to 1 have been met with when operating in as far as possible precisely the same manner. There is next a description of the methods adopted for obtaining pure specimens for analysis, *apropos* of which Professor Heddle gives the following letter from a former laboratory assistant.

Edinburgh, June 31, 1876.

Dear Dr. Heddle.—In reply to your note asking me to say how long I was engaged at the picking out of the Withamite, I have to say that it was my regular employment, when not called away for a temporary matter, from March to July, both inclusive, of Session 1873-74, and for some weeks of Session 1874-5.

I am yours truly,

R. M. MURRAY

A large series of analyses is then given, together with full details of localities, structural peculiarities, and modes of occurrence.

The following summarised tables we here re-produce as being exceedingly useful for reference.

ORTHOCLASE.

	Colour.	Cleavage Angle.	Specific Gravity.	$\ddot{Si}$.	$\dddot{Al}_2$.	$\dddot{Fe}_2$.	$\dot{Mn}$.	$\dot{Mg}$.	$\dot{Ca}$.	$\dot{K}_2$.	$\dot{Na}_2$.	$\dot{H}_2$.	Total.
		° ′											
Ben Capval	Blue	89 50	2·565	64·86	18·47	·67	...	·71	...	12·98	1·89	·5	100·09
Stromay, Harris...	Grey	89 55	2·574	65·35	17·68	·92	...	·25	·68	15·13	2·5	·18	100·69
Glen Fernate	Pink	90	2·525	63 99	17·06	2·47	...	·07	·52	14·85	·53	·65	100·17
Cowhythe. 3rd vein	Flesh	...	2·561	64·74	18 3	1·99	...	·04	·97	9 87	3·34	·17	99·43
Do., 4th vein	Do.	89 40	2·559	66 0	18·3	2·03	...	...	1·	10·02	3·19	·16	100·71
Clattering Briggs	Fawn	...	...	64·03	19 17	·3	·22	·94	1·4	11·84	1·37	·57	99·83
Rubislaw	Flesh	89 58	2·554	64·54	18·36	·32	...	·09	·36	13·05	2·58	·09	99·39
Lairg	Buff	89 59	2·555	62·62	19·63	·06	...	·64	·6	13·72	2·92	·13	100·32
Tongue	Green	89 43	2·569	64·2	18·39	·45	·15	·07	·72	12 75	2·95	·51	100 22
Froster Hill	White	89 58	2·548	63·31	18·17	·87	...	...	1·07	13·27	2·06	·81	99·51
Blirydrine	White	89 41	2·551	63·59	19·58	1·09	...	·08	·68	12·53	2·76	·42	100·73
Banchory	White	90	5·554	63·11	18·98	·98	...	·57	·88	13·06	2·34	·34	100·26
Balvraid	Blue	89 58	2·558	63·04	19·31	...	...	·21	·97	14 63	1·02	·56	99·74
Struay, Ross	Pink	...	2·543	65·	17·03	1·43	·69	...	·73	13·82	1·	·50	100·20
Do. Do.	Blue	89 50	2 545	64·19	17·39	1·2	·46	...	·69	13·31	1·96	·56	99 76
Canisp, Sutherland	Brick	...	2·545	63·54	17·36	1·87	·38	...	1·33	12·93	1·69	1·12	100·24
Ratio of Soda to Potash ⅔ to 1 ; to 2 to 1, Sanidines													
Corriegills	Colourless	...	...	66·85	17·24	·42	...	·06	1·22	9·2	4·32	·86	100·17
Kinkell	Yellow	89 50	2·609	63·07	18·69	2·47	·06	...	2·2	6·62	5·5		99·99

OLIGOCLASE.

	Colour.	Cleavage Angle.	Specific Gravity.	$\ddot{Si}$.	$\dddot{Al}_2$.	$\dddot{F}_2$.	$\dot{Mn}$.	$\dot{Mg}$.	$\dot{Ca}$.	$\dot{K}_2$.	$\dot{Na}_2$.	$\dot{H}^2$.	Total.
		° ′											
Rispond	White	86 14	2·636	61·85	21·7	3·37	·2	·09	4·13	1·63	6·95	·37	100·29
Coyle	Cream	86 32	2·627	63·54	21·45	1·86	...	·23	3·88	1·07	7·64	·44	100·1
Barra Hill	Milk	86 12	2·834	64·67	22·18	1·44	...	·01	1·89	1·54	7·62	·15	99·53
Dyce	White	86 15	...	64·85	23 2	...	...	·2	·96	3·77	8·12	·01	101 12
Sclatty	White	...	...	59·53	21·05	1·81	...	·88	3·63	4·73	7·23	1·88	100·75
Rubislaw	White	...	2·637	62 53	23 52	1·28	...	·36	4 97	1·32	6·19	·6	100·78
Craigie Buckler	White	86 14	2·622	61·58	22·	1·28	...	·32	4·19	1·52	8·27	·54	99·67
Lairg	Colourless	86 15	2·618	62·81	22 92	·16	...	·08	4·25	·84	8·53	·29	99·88
Canisp	Cream	...	...	64·44	20·47	·88	·38	...	1·3	1·13	9·96	1·46	100·02

LABRADORITE.

Portsoy, massive	White	...	2·672	53·03	29·85	·13	...	·61	11·44	·64	4·21	·42	100·34
Hart-o-Corry	White	...	...	49·15	29·62	1·15	...	·91	15·31	·69	2·91	·73	100·39
Loch Scavaig	Grey	86° 42′	2 715	50 81	29·48	·25	...	·12	12·69	·55	3 92	2·48	100·29
Glen Bucket	White	...	2·674	50·59	28 33	3·05	...	·59	11·17	2·18	2·56	1·42	99·89
Balta	Lavender	...	2 95	52 21	29·64	·48	...	·26	12·43	·44	4·	·11	99·57
Do.	White	...	2·954	53·14	29 99	·25	...	·21	12 3	·47	3·86	·21	100·42
Portsoy crystals	Grey	86 42	2·83	52·41	28 96	·15	·91	·54	10 85	1·61	3·48	·93	99·84
Kildrummy	Cream	...	2·674	51·31	26 76	1·82	·76	·41	10·14	2·11	6·43	·68	100 42
Kinneff...	Colourless	86 40	...	53·19	26·43	2·85	tr.	·92	9·68	1·51	4·59	·73	99 91
Balvraid, granular	Wax	...	2·708	47·44	28 02	·34	...	·41	11 03	3·51	4·61	5·2	100·58
Do. fibrous	Wax	86 40	2·705	49·33	26·7	·25	...	·07	11·02	2·59	5·25	4·84	100·06

ALBITE.

	Colour.	Cleavage Angle.	Specific. Gravity.	$\ddot{Si}$.	$\dddot{Al}_2$.	$\dot{Fe}$.	$\dot{Mg}$.	$\dot{Ca}$.	$\dot{K}_2$.	$\dot{Na}_2$.	$\dot{H}_2$.	Total.
Stromay, Harris ...	Grey	86° 21′	2·627	66·97	19·46	·6	·21	2·04	1·23	9·54	·31	100·36
Colafirth, Shetland —"beautiful rock"	White	...	2·622	66·8	17·83	1·13	·14	1·5	·92	11·52	·48	100·32
Colafirth	White	86 45	2·61	66·84	16·73	2·42	·37	·94	·73	10·76	·89	99·69
Hillswick	Pink	...	2·615	66·71	19·81	·9	·09	1·38	1·26	9·23	·54	99·93
Cleavlandite	White	...	2·622	67·79	18·76	1·43*	...	·52	·76	10·49	·16	99·96

ANDESINE.

* $\ddot{Fe}_2$ also ·08 $\dot{Mn}$.

	Colour.	Cleavage Angle.	Specific Gravity.	$\ddot{Si}$.	$\dddot{Al}_2$d.	$\ddot{Fe}_2$.	$\dot{Mn}$.	$\dot{Mg}$.	$\dot{Ca}$.	$\dot{K}_2$.	$\dot{Na}_2$.	$\dot{H}_2$.	Total.
Glen Urquhart ..	White	86° 28′	2·672	58·38	22·5	2·12	·15	tr.	5·34	3·2	5·21	3·41	100·31
Glen Gairn	Blue ...	86 21	2 705	57·18	24·04	1·12	..	·12	6·11	2·83	7·13	1·6	100·13
Do.	White	...	2 689	56·96	23 81	·94	...	·09	7·98	2·56	6·85	1·62	100·81
Crathie	White	86 24	2·677	56·3	25·71	·97	tr.	...	9·35	1·49	4·72	1·82	100·36
Portsoy	White	...	2·692	58·36	23·34	·24	...	·5	8·24	1·15	7·84	·53	100·21

ANORTHITE.

	Colour.	Cleavage Angle.	Specific Gravity.	$\ddot{Si}$.	$\ddot{Al}_2$.	$\ddot{Fe}_2$.	$\dot{Fe}$.	$\dot{Mn}$.	$\dot{Mg}$.	$\dot{Ca}$.	$\dot{K}_2$.	$\dot{Na}_2$.	$\dot{H}_2$.	Total.
Fetlar, Shetland ...	Cream	...	3·099	46·92	30·77	...	...	tr.	·09	16·34	1·5	3·07	1·54	100·24
Londalfoot, Ayr ...	Greyish	86·42	2·761	44·22	31·44	1·95	...	...	1·	14·18	1·48	1·63	3·69	99·59
Glengairn	Green	...	2·958	46·42	21·86	...	5·92	·69	2·92	18·38	1·26	1·69	1·08	100·23

LATROBITE.

Glengairn	Rose ...	...	2·749	45·2	31·04	3·43	tr.	·68	1·2	5·21	7·12	·49	5.7	100·06
Do.	Do.	...	...	46·87	29·31	2·31	·11	1·15	1·38	6·46	7·31	·83	4·49	100·21

The conclusion of the paper is as follows :—

"In reviewing the results of this extensive series of analyses, the first point calling for consideration is the light (if any) which is thrown by it on the ever-recurring question as to the specific distinction between the felspars,—the number of species into which they are to be divided.

In speaking of the light that may be thrown upon the question, I would not have it thought that I consider it now as an open one; I conceive that the masterly paper by Descloiseaux in the *Comptus rendus** has definitely settled the matter, and must have satisfied Tschermak himself. Nor would I reduce it to a mere question of personal opinion or experience, by enumerating the grounds which have induced me long to take the view advocated by Descloiseaux; but—postponing, to the second part of this paper, the chemical consideration of the subject—I would only endeavour, meantime, to strengthen his position by drawing attention to the evidence of the rocks themselves, as clearly declared by the geognostic position of the minerals.

All mineralogists admit the three species, orthoclase, albite, anorthite; —some also labradorite,—but do not admit oligoclase or andesine.

It appears to me that, in Scotland, the geognostic relations of the three last bear out their specific individuality quite as thoroughly as that of the universally acknowledged species is borne out.

Reviewing each in turn, and admitting only the evidence of such specimens as have either been actually analysed, or otherwise determined by evidence sufficiently cumulative to leave no room for doubt, we find true or ordinary *orthoclase* occurring in crystalline schists—as in gneiss at Glen Urquhart, Dee side, and central Sutherland; the associated minerals being hyaline quartz paste, carrying either Haughtonite or lepidomelane, and rarely apatite. Rarely in cavities of chlorite schist, as in Strath Alnack; the associates being chlorite and rutile. Exceptionally, otherwise then crypto-crystalline, in porphyry, with granular quartz and pinite, or black hexagonal mica (? Biotite) as associates. Exceptionally in syenite, as on Morven and Froster hills, and near New Leslie, in Aberdeenshire; the associates there being hornblende, menaccanite, and sphene. And very exceptionally (*necronite*) in granular limestone, the immediate associates being Biotite, balvraidite, and hydrous labradorite.

The more sodaic *sanidines* occur in tufa or in pitchstone.

The *corded orthoclases* alone occur in granitic veins, or bands; the ordinary associates being oligoclase and muscovite in a quartz paste; the more occasional associates, arranged in the order of the frequency of their occur-

* 8 Fevrier, 1875.

rence, being either Haughtonite or lepidomelane, tourmaline, apatite, garnet, beryl, magnetite, rarely ilmenite and pinite; and—where the veins cut syenite,—sphene, menaccanite, Allanite, Babingtonite, zircon, and thorite.

Though a constituent of a greater number of rocks than any other of the felspars, there are rocks in which orthoclase finds no place: its geognostic habitudes are therefore clearly defined.

Albite in Scotland is confined to the somewhat hornblendic and epidotic red granite of Peterhead, the rare associates being agalmatolite and fluor.*

A rock *sui generis*, which is associated with serpentine, and which stretches in a belt from Fethaland Point to Hillswick Ness, contains it in association with hornblende, or with augite; a graphic vein near serpentine, at Bigsetter Voe, may be an offset from the above.

An exceptional occurrence is that of the moonstone of Stromay, where it would appear to replace oligoclase. The geognostic relationships of albite in Scotland are therefore ill-developed, if not also ill-defined.

Anorthite in Scotland seems to replace labradorite in the diabase of Fetlar, and in portions of the gabbro of Ayrshire; as Latrobite it very rarely is found in granular limestone in Glen Gairn. Its relationships therefore are also ill-defined.

The habitudes of the other—the doubted—species are much more definite and clear.

Labradorite finds its place, admitting no other felspar to play its part, or even associate itself with it, in all the varieties of diabase,—gabbros, primative greestones, diallage rock, "heathens"—or whatever name their varying features may procure them—from Balta to Ballantræ. Showing a slight tendency to pass over to anorthite very rarely; only in one case (Fetlar) yielding to it. Even when in Glen Bucket the rock actually passes into diorite, the felspar is unchanged.

Nor has it stepped far afield when it also asserts itself as the felspar special to the poryphyritic amygdaloids of the south-west and north-east. LE HUNT showed it to be the felspar of the traps on both sides of the Clyde, and we now find it to be that of Bervie, Kinneff, Thornyhythe, Tremuda, and all that coast.

Nothing could be stronger than the evidence of the rocks as to the specific individuality of this mineral.

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* The "felspar" of the rock of Corstorphine hill is usually called albite,—it has not been analysed.

Oligoclase again presents itself as the very frequent associate of the corded felspar in granite veins*—only in one locality (Coyle) is it found in another association; the evidence as regards it is also perfectly definite. No one who has become familiar with the ever-recurring exfiltration veins—called *crocus* by the quarrymen—which lace the grey granite of Aberdeenshire, will hesitate in considering the well-defined crystals of the *white* felspar of these veins to be as thoroughly good a species as the accompanying flesh-coloured orthoclase.

A similar association with orthoclase is also to be seen in the veins—whether intrusive or exfiltration—which occur in hornblendic gneiss;—as at Rispond, and Geo na Shermaig.

And I consider that it is even more singularly clear as to the last of the felspars—that which is generally held to be the most doubtful.

Andesine is by many held to be merely an altered oligoclase; but in Scotland oligoclase is a *granitic* felspar, andesine is a *gneissic* one; and it occurs only in, or in near proximity to primary limestone. One would have expected that the felspar specially pertaining to limestone would be the most calcareous of all; but it is not so; with the exception of the limestone locality at Glen Beg, andesine is the only felspar I have found in limestone—and it occurs only with limestone.

In Scotland it cannot, for two reasons, be altered oligoclase:—first, there is no oligoclase with it, or near it; and second, it is perfectly fresh, lustrous, undecomposed,—and in larger crystals than the oligoclase which occurs elsewhere.

In Scotland, therefore, the felspars belong so specially each to its own rock, that if we can tell the felspar, we may say that we are well on in the determination of the rock.

But can we tell the felspars? That is—can we discriminate between them, as they ordinarily occur in rock masses?

That they can† be distinguished by the employment of the polariscope according to the method established by Descloiseaux, we know; but the bulky polariscope could not be employed in the field, even supposing that the obtaining plates sufficiently delicate for that mode of investigation were an effort of ordinary skill, which is very far from being the case.

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* It also constitutes the bulk of the grey granite of Aberdeen; this I find generally to consist of a great deal of oligoclase, little orthoclase, comparatively little quartz, very small quantities of muscovite, and a good deal of Haughtonite. The hornblendic gneiss of the Cape Wrath district frequently consists almost solely of a granular mixture of oligoclase and hornblende.

† Except as regards the discrimination of oligoclase and andesine.

We have the old physical distinction of striation, laid down as infallible in separating the ortho from plagio-clastics; let us see this to be an infallible test, or what value is to be assigned to it.

No twinning of orthoclase has yet been shown to be so repeated as to exhibit the phenomenon.

Does the absence of striation then entitle us to pronounce the felspar to be orthoclase?

Reverting to the physical descriptions of the felspars analysed, we find that to the eye, or to the lens, there exhibited striation—of four albites, *one*—rarely; of ten oligoclases, *four*; of four andesines, *one*; of ten labradorites, *three*; of two anorthites, *one*; of one Latrobite, *none*; or, altogether in the thirty-one plagioclastic felspars, striation was ten times seen, twenty-one times not seen.

The oligoclase near Lairg,—the crystals of which are perhaps larger than at any other locality,—is cream-coloured, and possibly somewhat altered by incipient weathering; it does not show striation. From the centre of one of these crystals, however, a clear colourless translucent portion was obtained, which was distinctly striated: here then, one and the same crystal had a striated and an unstriated portion, the striated being inside.

We are hardly therefore justified in going even the length which COTTA does when he says—"This striping, when observable, is a very characteristic sign; but its absence is not equally so."

But it can only profess to be characteristic as between the ortho and the plagio; for its being seen indiscriminately, sometimes in coarse pattern, sometimes of microscopic minuteness, among all the plagioclastics, renders it inapplicable as a mode of discriminating among *them*; and there is reason to believe that the time even now is, when it is more imperative that the field geologist should be able to determine between the various plagioclastic felspars, than even to recognise "common felspar."

Let us now see what aid we derive from specific gravities.

The specific gravities of Scottish Orthoclases, numerically arranged, are the following,—the numbers being in some cases the mean of several determinations:—

Pitfechie Monnymusk, Aberdeen ..	2·503
Glen Fernate, Perthshire..	2·525
Ben-na-chie, Aberdeen	2·534
Ben Resipol, Argyle	2·538
Blackwater, Ross-shire	2·54
Loch of Leys, Aberdeen	2·542
Struay, Ross	2 544
Sclattey, Aberdeen	2·545

Canisp, Sutherland	2·545
Froster Hill, Aberdeen	2·548
Yestnaby, Orkney	2·549
Rinashat, Aberdeen	2·55
Blirydrine, Kincardine	2·551
West Stocklet, Harris	2·552
Rubislaw, Aberdeen	2·554
Lua-yayi, Erribol, Sutherland	2·554
Torry, Kincardine	2·554
Lairg, Sutherland	2·555
Scaire Ruidh, Harris	2·555
Anguston, Aberdeen	2·555
Scoltie Hill, Aberdeen	2·555
Midstrath, Aberdeen	2·555
Glen Beg, Glenelg	2·558
Rubislaw, pinkish	2·559
Shinness, Sutherland	2·56
Cowhythe, Banffshire	2·56
Spy Hill, Kincardine	2·562
Rubislaw, grey	2·562
Geo na Shermaig, Cape Wrath	2·563
Ben Capval, Harris	2·565
Tongue, Sutherland	2·569
Stromay, Harris	2·574
Pitfodles, Aberdeen	2·579
Cowhythe Head, Banff	2·58

The average of these thirty-four is 2·553: the number 2·555 (occurring five times) may be more easily retained in the memory. The range ·077 is so small that the gravity of orthoclase must be regarded as a highly characteristic physical feature.

The specific gravities of the Albites determined are—

Colafirth Voe, Shetland (av. of 4)	2·607
Nudista, Hillswick (av. of 2)	2·615
Beautiful Rock, Colafirth	2·622
Cleavlandite, Sutherland	2·622
Moonstone, Harris	2·627

Average, 2·618; the range, ·02.

Of Oligoclase:—

Anguston, Aberdeen	2·611
Lairg, Sutherland	2·618
Craigie Buckler, Aberdeen	2·622
Ben Dubh, Coyle, Aberdeen	2·627
Rispond, Sutherland	2·636
Rubislaw, Aberdeen	2·637
Geo na Shermaig, Cape Wrath	2·654
Barrahill, Aberdeen	2·834

Average, 2·655; the exceptionality of the Barra Hill gives here the large range ·223. Excluding the anomalous Barra Hill specimen, the average is 2·629, and the range only ·043

Of Andesine:—

Glen Urquhart, Inverness-shire ..	2·672
Crathie, Aberdeenshire	2·677
Glen Gairn, white, Aberdeen	2·689
Cowhythe, Banffshire	2·692
Glen Gairn, blue	2·705

Average, 2·687; range, ·033.

Of Labradorite:—

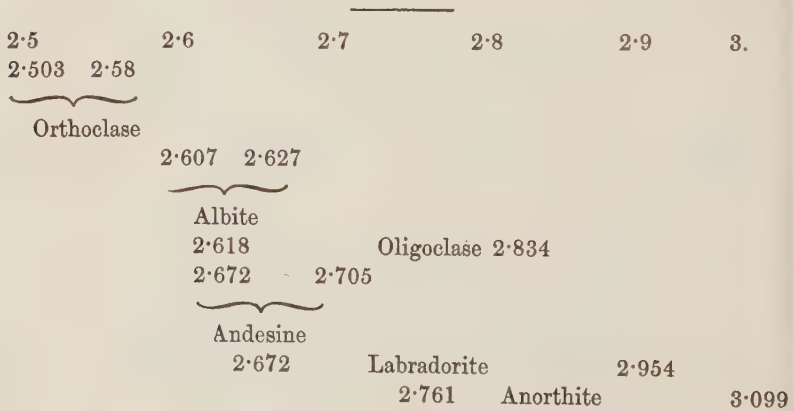
Portsoy, massive, Banffshire	2·672
Glen Bucket, Aberdeen	2·674
Kildrummy, Aberdeen	2·674
Badnagoach, Aberdeen	2·681
Balvraid, Glenelg, granular	2·705
Belvraid, Glenelg, fibrous	2·708
Loch Scavig, Skye	2·715
Portsoy, crystallised	2·813
Balta, blue, Shetland	2·95
Balta, white	2·954

Average, 2·755; range, ·282.

Combining Anorthite and Latrobite, we have—

Latrobite, Glen Gairn	2·749
Lendalfoot, Ayrshire	2·761
Fetlar, Shetland	3·099

Average, 2·87; range, ·35.



A consideration of the above diagram shows that, as there exists a well-defined gap between the specific gravities of orthoclase and the other felspars, the former might, failing other distinctions, be recognised by its low gravity: secondly, that as the gravities of each of the plagioclastic felspars *overlaps* from some localities those of the others, no one of these species can be individualised by the determination of its gravity.

It is interesting, however, to observe the gradual increase of gravity, as the percentage of silica is diminished, and that of alumina increased, in the different members of this family.

Gravity having thus failed to lend much aid, we turn to the cleavage angle. The use of the reflecting goniometer, in far shorter time than any other process of determination, and with unerring certainty, enables us to determine the orthoclases. But when we measure such rough cleavages as are to be obtained by the splitting up of imbedded crystals of the other felspars, we do not obtain all the aid that we might hope for.

Of Albites,—true angle 86° 24′,—there were got—

Stromay	86° 21′
Nudista, curved	86 32
Colafirth	86 45

Of Oligoclase,—true angle 86° 10′,—there were got—

Anguston	86° 10′
Lairg, colourless..	86 10
Rispond	86 14
Craigie Buckler	86 14
Dyce	86 15
Lairg, cream	86 15
Rubislaw	86 15
Coyle	86 32

Of Andesine,—angle according to Descloiseaux 87° to 88°,—there were got—

Glen Gairn	86° 21
Crathie..	86 24
Glen Urquhart	86 28

Of Labradorite,—true angle 86° 40′,—there were got—

Kildrummy	86° 28 to 86° 40
Kinneff (curved), about	86 40
Balvraid, about	86 40
Scavig	86 42
Portsoy..	86 42
Badnagoach	86 45

Of Anorthite,—true angle 85° 50′,—there was got—

Lendalfoot, *hydrous* .. .. .. 86° 42

This is not altogether satisfactory ; we have much the same overlapping that we had in the gravities : an angle of 86° 15′, or under that, would pretty certainly indicate oligoclase,—of 86° 40′ or over it, would indicate labradorite. The low angle with a low gravity,—and the high angle with a high gravity would make assurance more than doubly sure. This is about all that we can say, and it takes no account of albite, andesine, and anorthite, as regards at least their discrimination from one another.

Albite usually occurs in free crystals superimposed upon orthoclase ;—this is, however, the chronicling of a habit, not the observation of an inherent property.

Truly we are sadly in want of a rapid and trustworthy test.

As to whether the eye can be educated to the ordinary recognition of all these felspars as they occur in rocks, with the simple aid of the lens I can only say that,—after having selected from the rocks the specimens to be analysed, after having manipulated them by grinding on the lapidary's wheel for testing their gravity, after having examined with the lens their myriad chips in purifying them for analysis, and after having analysed them ; that is, after having obtained that absolute knowledge which enabled me to correct my own errors,—I should not like to have to pronounce upon certain obscure varieties ;—but, that if I did see such an amount of recognisable features as to warrant the expression of an opinion, I should be inclined to maintain it against that of any one whose eye had not been educated to a similar extent."

Andesine, anorthite, and Latrobite are now first introduced as British minerals.

J. H. C.

ARTIFICIAL FORMATION OF RUBIES, SAPPHIRES, EMERALDS, &c.—(*Comptes rendus.* lxxxv. p.102.) Fremy and Feil have lately succeeded in preparing artificially, variously-coloured crystallized corundum and emerald, of such size and transparency as to be suitable for the purposes of the jeweller and watchmaker. Several methods of preparation have been adopted, but that which is said to give the best results is to dissolve alumina in oxide of lead at a high temperature in an earthen crucible. After the solution is complete, the temperature is maintained for about 20 days. The silex of the crucible is gradually dissolved, and by replacing the alumina causes it to crystallize out very slowly. The remarkable success obtained is mainly due to the authors having used as much material as 20 or 30 kilogrammes, and having the command of

large furnaces. The variously coloured specimens of corundum have the same specific gravity, hardness, and crystalline form as the natural mineral. The artificial ruby was coloured, as is the natural, with oxide of chromium; but the artificial sapphire was coloured with oxide of cobalt, and they probably differ from the natural. Very blue sapphire does not give a spectrum at all like that due to cobalt. The true nature of the colouring substance is somewhat doubtful.

H. C. S.

Aluminium Plate as a Support in Blowpipe-work—(W. M. Hutchings, *Chem. News, Vol.* 36, *p.p.* 208-210, *and* 217-219). Attention is drawn to the many advantages possessed by the Aluminium plate, first introduced by Major Ross, as a substitute for charcoal or for the porcelain support suggested by Dr. Foster, for obtaining and examining sublimates by the blowpipe. Directions are given for preparing the plate for use. It is made from a strip of sheet-aluminium about 5 inches long by 1½ inches wide, of about the thickness of a sixpence. At one end a ledge of about ½ inch is turned up so as to make rather less than a right angle with the rest of the plate; and the surfaces of plate and ledge are polished with bone-ash and water.

Substances to be tested are laid either directly on the ledge, or on a small slip of charcoal about ½ inch square and as thick as a penny, which rests on the ledge. The plate is held by steel forceps in such a manner as to be almost vertical, being only just sufficiently inclined to prevent the assay or the charcoal slip from falling off the ledge.

These little slips being the only charcoal required, and the plate being small and easily packed, there is a very great gain in portability and cleanliness as compared with the usual large pieces of charcoal; and as these latter are expensive, even when suitable pieces can be obtained at all, there is also a considerable gain in cheapness, an aluminium plate as above described costing 3s. 6d., and being indestructible with careful usage. But in addition to these advantages of portability, cleanliness and cheapness, the aluminum plate gives, in almost all cases, very much better indications of the volatile substances to be sought for. Its principal points of superiority over charcoal are as follows.

1st. Several sublimates in succession can be obtained from the same fragment of the assay. When laid directly on the ledge and gently heated, only the more volatile constituents come off, as the aluminium keeps the fragment from getting very hot. On heating more strongly, the plate and the assay get gradually hotter, and more and more sublimate is given off, till finally a limit is reached beyond which no

sublimate can be obtained. If the same fragment be now laid on one of the little slips of charcoal and heated again, sublimates are obtained of those constituents which could not be volatilised as long as the assay was partially covered by contact by the aluminium. Thus, for instance, a mineral containing antimony and lead will give off almost all the former on the bare ledge, while the latter will not be driven off till the assay is treated on the charcoal-slip.

2nd. Sublimates are much more compact and *concentrated* on aluminium than on charcoal;—partly because the plate remains comparatively cool, and also because the vertical surface prevents what is volatilised from being swept along by the blast and spread out so much as on ordinary charcoal.

3rd. When the sublimate is once formed, the aluminium having no further action upon it, many interesting and highly characteristic changes may be observed, by applying an oxidising or reducing flame. Most of these changes cannot be observed at all on charcoal; partly because its being black would hide them, but mainly because it immediately begins to glow under the sublimates whem the flame is applied to them, thus altering or destroying them.

Very full instructions are given as to the best mode of using the plate and of examining the sublimates; and finally the author gives a complete list of all the principal sublimates, with their characteristics and means of identifying them, from his own observations.

W. M. H.

DETECTION OF BISMUTH BY THE BLOWPIPE—VON KOBELL'S TEST.—(W. M. Hutchings, *Chem. News*, *Vol.* 36, *p.* 249). Von Kobell's excellent test for the presence of Bismuth in minerals, &c., consists in heating the powdered substance on charcoal, with a mixture of potassium iodide and sulphur. If bismuth is present a fine bright red sublimate is obtained. The test-mixture is very deliquescent, owing to the potassium iodide, and cannot be kept, even in stoppered bottles, if often opened for use without in time getting pasty or even almost liquid. It has also the further defect of itself giving a copious white sublimate. The brilliant red colour obtained when bismuth is present, is caused by the mixture of this white of the potassium salt with the deep red-brown given by bismuth iodide. If very little bismuth is present, and at the same time some other substance which gives a light-coloured sublimate, this white from the test-mixture very materially assists in obscuring the bismuth, which may thus easily escape detection. To remedy these defects the author uses cuprous iodide to replace potassium iodide. Pure precipitated

cuprous iodide is washed free from all trace of potassium salt, dried and then intimately rubbed up with an equal bulk of flowers of sulphur. This mixture is not deliquescent and can be kept in the little wooden boxes of the portable blowpipe-apparatus. It yields at most a trace of whitish sublimate. Using this mixture and Major Ross's aluminium plate, the test is very much increased in delicacy, and is highly recommended by the author.

The substance to be tested is finely powdered, and intimately mixed with twice its bulk of the reagent, made into paste, laid on a slip of charcoal on the ledge of the plate, and very gently heated, after previously warming the plate sufficiently to prevent condensation of iodide, or of moisture, which latter destroys the bismuth sublimate. The red-brown bismuth iodide is very conspicuous on the white aluminium. As little as 0.1 p.c bismuth can be frequently detected in copper ores, regulus, &c.

Lead is the great enemy of this test, lead iodide giving a brilliant yellow which hides the bismuth colour. Cornwall found thatwith 95 parts lead oxide and 5 parts bismuth oxide, Von Kobell's test no longer gave proof of the bismuth. But by using the cuprous iodide mixture and aluminium plate, bismuth can be detected when 1 part of its oxide is mixed with 99 parts of lead oxide.

W. M. H.

Zeitschrift für Krystallographie, &c. Sechstes Heft.

THE present number brings the first volume of this valuable journal to a close. It contains, besides the usual amount of mineralogical and crystallographical matter, two indices, one of authors, and one of subject matter, and also a table of contents. A glance over the latter will show conclusively that a real demand has been successfully met by the publication of a central organ for this branch of the natural sciences, for we find here literally contributions from almost all parts of the world; and, that the future prosperity of Prof. Groth's Zeitschrift need no more be doubtful, as the wide and sound basis on which it has been placed will make it invaluable to all students of the sciences to which it directly or indirectly appeals.

Among the memoirs of this number, of interest to the mineralogist, are the following:—

Crystallographical and Optical Researches on Glauberite, by H. Laspeyres.—The colourless and perfectly transparent crystals, of the usual form, imbedded in clay nodules, from Aranjuez, in the valley of the Tagus, are exceptionally well developed and permit the most exact goniometrical

measurements, the results of which are given, and which differ only slightly from those of other authors. But the chief value of this paper attaches to the exhaustive investigation of the optical properties of this substance, which is peculiarly adapted for the exhibition and determination of the changes which the optical constants of biaxial media undergo when subject to different temperatures, as it becomes uniaxial for different wave lengths of light, at temperatures which lie within the boundaries of practical experiment, thus offering material for determining the laws that govern these changes.

ON SODA-ORTHOCLASE FROM PANTELLARIA, by H. Fœrstner.—The trachytic rocks of this island are unusually rich in soda, which is referable to the felspar that they contain. The chemical, crystallographical, and especially the optical properties of the latter, lead to the distinction of two varieties of monoclinic soda-felspar, with a composition that agrees with that of an isomorphous mixture of the triclinic albite with monoclinic potash felspar, thus proving the dimorphism of the compound Na Al Si_3 O_8, while the dimorphism of K Al Si_3 O_8 has already been proved by Descloizeaux' discovery of microcline.

The composition of the two varieties is represented by the following analysis :—

	1.	O ratio.	2.	3.	O ratio.
SiO_2	66·63	12·1	63·41	69·503	13·1
Fe_2O_3	0·72	——	3·27	——	——
Al_2O_3	19·76	3·1	20·32	18·370	3·0
CaO	0·38	1·0	2·76	——	——
MgO	0·30		0·30	——	——
Na_2O	7·31		7·42	8·689	1.0
K_2O	4·86		2·53	3·435	
	99·96		100·01	99·997	
Sp. Gr.	2·55		2·61		

1. From the crater Cuddia Mida. Optically homogenous.

2. From Monte Gibele. Optically non-homogenous, containing interposed laminæ of a triclinic felspar, probably labradorite.

Analysis 3 represents the calculated composition of the orthoclastic part.

The following table is reproduced to show the connection between the chemical and physical properties of these felspars as compared with typical orthoclase and albite.

No	Sp. Gr.	Molecular ratio.	Ratio of axes.	Oblique Angle.	Interfacial Angles.			Optical Properties.	
		K_2O: Na_2O			T : T	P : y	P : n	Angle of I bisectrix with oblique axis.	Angle of optic axes (in oil).
1	2·573	1 :1-7th	0·6535 : 1 : 0·5521	63° 57′	60° 50′	81° 2′	44° 12′	4° 35′	—
2	2·57	1 : 1½	0·6492 : 1 : 0·5517	63° 54′	60° 28′	80° 33′	44° 43′	6° 30′	151°19′
3	2·55	1 : 2½	0·6358 : 1 : 0·5468	63° 38′	59° 19′	81° 23′	44° 22′	8° 30′	142°52′
4	(2·61)	1 : 4	0·6246 : 1 : 0·5498	63° 17′	59° 35′	82° 28′	44° 29′	(8° 6′)	135°46′
5			0·6333 : 1 : 0·5575	63° 32′	59° 13′	82° 6′	43° 10′ 46° 46′	(20·0)	83°5′

1. Adularia, from Pfitsch.
2. Sanadine, from Laach.
3. Felspar, from Cuddia Mida.
4. Felspar, from Monte Gibele.
5. Albite.

Crystallographic Studies on Hematite and Ilmenite, from the Binnenthal, by H. Bücking.—A purely morphological investigation, but remarkable for the discovery of a large number of new forms, principally scalenohedrons, with very complex indices. The hematite crystals are from the Alp Lercheltini, a locality which has of late proved extremely rich in rare and interesting minerals, where they are found in clefts of the gneiss, associated with adularia, quartz, magnetite and rutile. They are classed under seven types, each of which is characterised by forms peculiar to itself, with only the basal plane and the rhombohedron + R common to all; of these types again the seventh is the most common; to it belong the so-called "Eisenrosen" which are titaniferous and usually show small crystals of rutile regularly grouped on the basal plane.

A crystal of ilmenite shows an unmistakable tetartohedral developement, thus confirming the observations which Kokscharow made on the ilmenite from the Ilmen mountains.

The author has observed 31 forms on the hematite and ilmenite of the Binnenthal, of which only 9 have been enumerated; but of the 22 new ones, the indices of only 17 could be made out with any degree of certainty. These latter are appended in a tabular form together with the list of 78 forms published by Strüver in his *Studi cristallografici intorno alla Ematite di Traversella, Torino*, 1872, thus bringing the number of known forms up to 95.

In addition to the regular associations of hematite with rutile and magnetite with rutile already known from this locality, the author describes a third one, namely, the implantation of an octahedron of magnetite on the basal plane of a hematite crystal in such a manner that the dominant plane of the former lies parallel to this basal plane, and its edges coincide with the diagonal axes of the hematite crystal.

On Gismondite, by A. Schrauf.—The mineral occurs sporadically with natrolite and analcite, in cavities of basalt at Salesl, in Bohemia. The results of measurements on two small crystals lead to the adoption with *v.* Lang (*Phil. Mag.* 1864, *vol.* 28), of the prismatic system, with

$$\breve{a} : \bar{b} : \acute{c} = 0{\cdot}99246 : 1 : 0{\cdot}94897$$

The observed forms are: (011) (110) (101), and the crystals are twinned with (011) as twinning plane, generally forming cross-macles after the manner of bournonite. It is this inclination to repeated twinning which has caused so much difficulty in the determination of the crystallographic elements of this species, and the question is here only considered as emporarily decided until more perfect material be found.

The second instalment of G. vom Rath's "*Mineralogische Mittheilungen*," contains the following articles:—

"On a Strange Association of Bournonite Crystals."—Four small prismatically developed individuals are so closely approximated to one another as almost to touch. They possess a common vertical axis, and are very nearly though not absolutely in the twinned position so common to this mineral. They have obviously influenced each other during their formation. The specimen is from Nagyag and consists of quartz, blende, and rhodochrosite.

"Calcite from Bergen Hill, New Jersey."—The crystals of calcite from this locality which seem hitherto to have escaped all but casual notice, are interesting on account of their variety of type and form and of a peculiar super-position which is common to most of them, so that a primary crystal of one type is partially overlapped by a secondary growth of another type. A minute discussion of the properties of six new scalenohedrons, with remarkably complex indices, touches again the vexed question of the rationality of the axial sections in this species. The calcite is found on a matrix of serpentine unassociated with other minerals.

"On a new Crystallised Tellurium-gold Mineral, the Bunsenine of Krenner."—Minute silver-white crystals of the prismatic system occur with pyrites and quartz on a piece of gangue rock from Nagyag. Morphologically and chemically they are identical with Krenner's bunsenine, which is composed of tellurium and gold. But as the name

"bunsenite" has already been given to the oxide of nickel from Johanngeorgenstadt, it is proposed to name the above mineral "Krennerit," after its discoverer Prof. Krenner, of Budapest. It is to be compared with Genth's calaverite ($Au Te_4$), petzite from Nagyag, and with hessite (Ag Te).

C. O. T.

Zeitschrift für Krystallographie, &c.—Zweiter Band. Erstes Heft.

ORIGINAL Memoirs on some Tellurium and Vandium Minerals, by F. A. Genth. The new minerals—coloradoite, magnolite, ferrotellurite, and roscoelite, described in this paper, have already been noticed in our Magazine from a different source. The author concludes that the vanadium in the latter mineral exists solely in the state of $V_2 O_3$, and has republished the analysis, with the necessary correction.

The other minerals described are native tellurium, hessite, calaverite, and tellurite, mostly from mines in Colorado; a green mineral from Colorado, probably a variety of roscoelite, and volborthite from Siberia. A complete analysis of the latter mineral shows that it is closely related to psittacinite; it contains Ba and Ca, but no Pb.

The Mica Group, part I., by G. Tschermak.—It is proposed to give a short account of this classical research after its completion.

Walnewite, a new variety Xanthophyllite, by N. von Kokscharow.—Occurs in chloritic schist near Achmatowsk, associated with perowskite and other minerals, in tabular and laminar crystals, often with hexagonal outline. Externally it is very like clinochlore, but much harder. Cleavage basal, very perfect. H=4.5., G=3·093. Colour leek, or bottle-green. Transparent in thin plates, translucent. Lustre vitreous, pearly on cleavage face. Dichroism very pronounced, green parallel to the vertical axis, reddish-brown at right-angles to it. Composition:

$Si O_2$	16·90
$Al_2 O_3$	43·55
$Fe_2 O_3$	2·31
Fe O	0·33
Ca O	13·00
Mg O	17·47
$H_2 O$	5·07
	98·63

Crystals often very perfect, but the faces not sufficiently polished for exact measurement. The form is similar to that of mica, and referable to the fundamental elements adopted for the latter by Tschermak. The axial elements and observed forms are:

$$a : b : c = 0.5768 : 1 : 3.2728$$
$$\beta = 90° 0'$$
$$(001), (102), (\bar{1}34), (014), (130), (118), (\bar{1}\bar{1}8).$$

Twins very common, after the same law as mica, viz.: twinning plane (110), composition plane either (110) or (001). Optic axes in the plane of symmetry, with an apparent angle in air, for different colours, of abont $20\frac{1}{2}°$. Inclination of acute bisectrix to the normal of (001) is 32′, for rays of medium refrangibility.

ON MIARGYRITE, by A. Weisbach.—A continuation of some former researches on this mineral (*Pogg. Ann.* 125, 441). The examination of a very fine small crystal, from Bräunsdorf, led to the elements:

$$a : b : c = 1{\cdot}0136 : 1 : 1{\cdot}3026.$$
$$\beta = 48° 38'.$$

The great angular variations observed in different crystals are explained by partial isomorphic substitution of the principal components.

The author concludes, from the specific gravities, and the constituents, as far as these are known, that kenngottite from Felsöbanya (G=5·31—5·47) is a variety of, and hypargyrite from Andreasberg (G=5·21—5·27) identical with miargyrite.

This view is fully borne out in L. Sipöcz' paper on miargyrite and kenngottite, which is abstracted in this number of the "Zeitschrift." The following analyses are given:

I and II, miargyrite from Felsöbanya; III, miargyrite from Bräunsdorf (H. Rose); IV, kenngottite from Felsöbanya.

	I	II	III	IV
S	21·65	21·94	21·95	20·66
Sb	40·86	40·50	38·61	39·46
Ag	32·74	32·80	36·40	35·28
Pb	3·95	4·07	..	1·76
Cu	0·50	0·52	1·06	0·50
Fe	0·23	0·14	0·62	0·25
	99·93	99·97	98·64	9·791
	G=5·273 — 5·322			G=5·29—5·38

These all correspond with the formula Ag Sb S_2, if Pb be assumed as replacing Ag_2. Kenngottite may therefore be described as a plumbic miargyrite, or as an isomorphic mixture of Ag_2 Sb S and Pb Sb_2 S_4.

On some Modifications of Groth's Universal Apparatus, &c., by L. Calderon.—The principal improvement suggested is the replacement of Brezina's composition plate of calcite, in the stauroscope, by a plate prepared from an artificial twin of calcite. This arrangement permits a much more exact determination of the position of the axes of elasticity, and does not strain the eyes of the observer to such a painful extent.

On the Crystallisation of the Diamond, after G. Rose's Posthumous notes, by A. Sadebeck.—This lengthy monograph is divided into several parts. A short historical introduction and a summary of the literature precede a minute description of the simple forms, combinations, twins, and the external development of the diamond crystals; this is followed by a chapter on the crystallotectonics or structure of the diamond, and by a classification of the different crystal-types. It appears that the South African diamonds are mostly combinations of the octahedron (rarely with indented edges) with hexakisoctahedrons, the Brazilian generally dodecahedrons with rounded faces, often approaching to flat hexakisoctahedrons, or tabular twins and octahedrons, the latter mostly with indented edges, the Indian mostly octahedrons.

The principal result arrived at is, that the diamond crystallizes holohedrally. The original memoir is illustrated by four quarto plates.

On the Crystallographic System and the Angles of Mica by N. von Kokscharow.—The main results of this research agree very closely with those of Tschermak, and show that all the micas crystallize in the monoclinic system, and exhibit monoclinic symmetry, with the axial angle $ac = 90° 0'$, and the prismatic angle $= 60° 0'$.

The Determination of the Refractive Indices of Solids by means of Total Reflection, by F. Rohlrausch.—The angle of total reflection is determined by means of a small instrument named a "Total-reflectometer." It consists of a small wide-necked bottle with a part of its side ground away vertically, and replaced by a glass plate with parallel surfaces; in the neck is fixed horizontally a graduated circle, which is pierced in the centre by a vertical axis, which carries a vernier at its upper end, and the substance of which the refractive index is to be determined, with one polished plane in a vertical and centred position, at the lower one. A small horizontal telescope, with a hair-cross in the focus, is placed in front of the glass plate. In order to make the point of total-reflection visible, the substance must be immersed in a fluid of greater refractive power than itself; for this purpose the bottle is filled with bisulphide of carbon (coeff. 1, 6.) If diffused monochromatic light be now allowed to fall on the bottle, the angle between the two positions, at which total reflection takes place, can be accurately measured. The size of half this angle multiplied

by the coefficient of refraction of bisulphide of carbon gives the index of refraction of the substance under examination. This method gives extremely exact results up to the fourth decimal, and is equally applicable to amorphous substances, as to regular and uniaxial and biaxial crystals, provided in the two latter cases the polished plane be parallel to two axes of optical elasticity, and a Nicol prism be connected with the telescope.

An appended comparative list of indices demonstrates satisfactorily the reliability of this easy method.

C. O. T.

THURINGITE IN CARINTHIA, by Prof. V. von Zepharovich (*Report of the Imp. Geol. Inst., Vienna, Oct.* 31, 1877).—In 1876, Mr. Seeland ascertained the presence of a chloritoid mineral, very nearly allied to Thuringite, in a gold mine, near the Zirm Lake, at an altitude of 2484 mètres. It occurred in crystalline groups, within the cavity of a felspathic vein running through central Alpine gneiss. It is either regularly rhombohedral in form, or quite indistinct. Both these varieties present many fissures as if cut through with a knife; and, on a triangular surface-plane, striæ crossing each other under angles 60°. These forms take their origin from cellules of lamellar calcite, having filled up the interstices, and having subsequently disappeared from the action of a solvent. The form of the Thuringite is occasionally exactly coincident with the combination OR, R, resulting from the union of four lamellæ of calcite. Anatase in extremely minute crystals is here and there interspersed through the feldspathic matrix.

T. R. J.

ON THE ORIGIN OF SOME ORES OF COPPER, by C. A. Burghardt, Ph. D.—The author has prepared *Cuprite* by both dry and wet methods, and *Chalcotrichite* and *Malachite* by wet methods.

J. H. C.

PYROPHOSPHORITE (Chas. U. Shephard, junr., *Am. Journ. Science*, Jan. 1878).—This is a new anhydrous phosphate of lime from the west Indies. Snow-white to bluish-gray and opaque. Sp. gr. 2·5—2·53, H 3—3·5 B.B. fuses with difficulty on the edges to a white enamel.

The mean of several analyses gave—

Loss on ignition	0·390
Lime	44·462
Magnesia	3·090
Sulphuric acid	0·628
Phosphoric acid	50·799
Silica	0·367
Oxide of iron and alumina	0·437
	100·173

The mineral is (essentially) anhydrous ortho-pyrophosphate of lime with pyrophosphate of magnesia. The proportion of phosphoric acid exceeds that of any known calcic-phosphate.

J. H. C.

Tridymite.—Prof. A. von Lasaulx reports the discovery of tridymite, in the trachyte-porphyry of Co. Antrim, Ireland.

J. H. C.

Variscite from Arkansas (*Am. Journ. Science*, March, 1878).—Figures of macled crystals belonging to the rhombic system, are given by Albert H. Chester.

J. H. C.

Tantalite, from Coosa County, Alabama, by J. Lawrence Smith (*Am. Journ. Science*, March, 1878).—This is the first recorded occurrence in the United States, although the related mineral, Columbite, occurs in many places.

The analysis is as follows:—

Tantalic acid	79·65
Tungstic acid	1·10
Stannic acid	·87
Manganous oxide	3·72
Ferrous oxide	13·51
Oxide of copper	·89
	99·74

Sp. Gr. .. .. 7·305 to 7·401.

Occurs in irregular masses, more or less rounded, ready cleavage in one direction. Some masses weighed 1¼ lbs.

J. H. C.

Vermiculite (Geo. H. Parke, Proc. Geol. and Polytech. Soc., Yorks., iv. 1877, p. 254).—This mineral has been found in Britain for the first time at Walney Island, North Lancashire, by Mr. C. E. Manby. It occurs in blocks of red and grey granite taking the place of mica, forming part of the boulder clay deposits of that locality. The mineral exfoliates very characteristically.

The following analyses are given—

	BEFORE IGNITION.	AFTER IGNITION
Ferric oxide	22·78	26·00
Manganic oxide ..	1·50	1·72
Alumina	6·24	7·12
Titanic oxide	1·15	1·32
Lime..	2·19	2·50
Magnesia	11·83	13·50
Phosphoric acid ..	0·49	0·56
Soda	3·19	3·64
Insoluble residue ..	38·23	43·64
Water, combined ..	12·00	none.
	100·00	100·00

The insoluble residue was also analysed with the following result—

Silica..	85·00
Alumina	10·20
Soda	4·80
Magnesia	trace.
Sulphuric acid	trace.

J. H. C.

The General Principles of Mineralogy, by J. H. Collins, F.G.S. (Post 8vo, pp. 206. W. Collins and Co., London and Glasgow, 1878.)

MR. Collins' new work is mainly a treatise on Crystallography, for two-thirds of the book are devoted to this branch of mineralogy. This stumbling block of the student is dealt with in a very clear manner; and, aided by more than five hundred woodcuts, he ought to have very little difficulty in acquiring a good knowledge of the subject. Mr. Collins gives the symbols used by Mitchell, Miller, and Naumann, so the student can choose whichever system happens to be adopted by his teacher. The latter chapters of the book give an account of the physical and chemical characters of minerals, blowpipe analysis, paragenesis, and artificial minerals.

There are a few omissions and errors, to which we cannot help calling attention. It surely would have been better to have given a figure of a regular specific gravity bottle, than the beaker shown in fig. 550.* No mention is made of Jolly's spring balance for determining specific gravities, which was recommend by von Kobell many years ago. We regret that Mr. Collins should not have thought it worth while inserting Werner's list

* The special convenience of the small beaker for determining the specific gravity of comparatively large crystals is a good reason for its introduction,—the ordinary sp. gr. bottle is well-known.—Ed.

of colours. Of course it is too much to expect a plate with colours in a small work on mineralogy, but in a large volume we believe that a chromo-lithographed plate, showing the various tints, would be of considerable value. In describing the blowpipe test for sulphur, p. 186, Mr. Collins forgets to tell the student to add a drop of water.

In speaking of the age of tin deposits, p. 190, the word "older" seems to have been accidentally printed instead of "younger;" and in a list of the minerals usually accompanying gold, iron pyrites ought scarcely to have been omitted. A few typographical errors have escaped notice, such as "independ*a*nt," p. 188; "splend*a*nt," p. 162. In spite of these few defects, there can be no question about the value of Mr. Collins' work; it is certainly a marvel of cheapness, for the woodcuts alone are well worth the price of the book. We are glad to note that it is soon to be completed by a second volume devoted to descriptive mineralogy.

C. L. N. F.

Silberkies.—(*Jahrbuch für das Berg-und Hüttenwesen ins Königreiche Sachsen auf das Jahr*, 1878.) Under this head Prof. A. Weisbach describes the crystallized argentopyrite, lately found near Freiberg and at Marienberg; and argyropyrite, a new variety, also from the neighbourhood of Freiberg. The latter is intermediate between argentopyrite and sternbergite, as shown by the formulæ:

Sternbergite ..	..	$Ag\ Fe_2\ S_3 = Ag_3\ Fe_6\ S_9$
Argyropyrite	..	$= Ag_3\ Fe_7\ S_{11}$
Argentopyrite	..	$Ag\ Fe_3\ S_5 = Ag_3\ Fe_9\ S_{15}$

A general formula for the three minerals would be:

$$Ag_3\ Fe_{6+n}\ S_{9+2n}$$

n varying from 0 to 3. C. L. N. F.

Miargyrite.—(*Ibidem.*) Prof. Weisbach and his pupils have made some new goniometric measurements of miargyrite crystals, and their results do not altogether agree with those of Prof. Naumann.

C. L. N. F.

The Mines of the Parys Mountain, Anglesey.—By T. F. Evans. (*Trans. Geol. Soc., Manchester*, 1878.) Beds of iron pyrites, copper pyrites and "bluestone" (mixed sulphides of iron, zinc, lead and copper) occur intercalated between bands of felstone, shale, and quartz. The author considers that the ores were deposited in the same way as the copper pyrites in the *kupferschiefer*, and that the enclosing rocks are purely altered sedimentary strata.

C. L. N. F.

ZUR THEORIE DER BILDUNG DER ERZGÄNGE.—By Fridolin Sandberger. (*Berg-und hüttenmannische Zeitung*, *Nos.* 44 *and* 45, 1877). Prof. Sandberger has arrived at the conclusion that the contents of lodes are in the main derived from minerals existing in the enclosing rocks. Veins of heavy spar may have received the baryta from felspars containing that earth; fluor spar may have been deposited by the action of potassium fluoride dissolved out of mica on calcium carbonate, derived from the decomposition of oligoclase.

The most important part of the paper relates to proving the existence of valuable metals in silicates. Olivine always contains nickel and cobalt; the olivine from Nauroth, near Wiesbaden, contains 0·307 per cent. of oxide of nickel, and 0·006 per cent. of oxide of cobalt. In the palæopicrite, or olivine rock of Dittenburg, there is from 0·162 to 0·666 per cent. of oxide of nickel, which is further accompanied by copper, cobalt, and bismuth.

Prof. Sandberger has tested many varieties of hornblende and has frequently found copper and cobalt. The same metals are often present in augite, and specimens of that mineral in diabase from Andreasberg afforded in addition, lead, nickel, antimony, and arsenic.

Mica obtained from gneiss and granite, has yielded one or more of the following metals, silver, lead, copper, nickel, cobalt, bismuth, arsenic, and zinc.

Prof. Sandberger's investigations are, undoubtedly, of the greatest importance, and deserve the earnest consideration of geologists and mineralogists.

C. L. N. F.

PRIZE BLOWPIPE APPARATUS.—The prize of £10 and the silver medal offered by the Society of Arts for the best guinea blowpipe apparatus, have been awarded to Messrs. Letcher Brothers, of St. Day and Camborne. Their box, which is only 10½ ins. long by 4¾ wide and 3⅛ in. deep, contains no less than 42 different articles, and these are all packed in a highly ingenious manner. Each article fits into its own little recess and consequently neither paper nor wadding are required. The apparatus contains the necessary appliances for testing most minerals and ores, and the Messrs. Letchers' box will be found most useful to mineralogists, as well as to miners, chemists, and metallurgists. It undoubtedly far excels any set that has been sold here or abroad for the money, and the Society of Arts deserves the cordial thanks of students and practical men for having enabled them to get such a compact, portable, well filled, and well arranged blowpipe apparatus for so little money. We quite believe that if the Messrs. Letcher were to apply their ingenuity to the sets for

quantitative work, that they would soon produce an apparatus far better packed and in much smaller compass than those supplied by Herr Lingke, the well-known Freiberg maker.

C. L. N. F.

Guanajuatite (J. W. Mallet, *Am. Journ. Sci.*, Ap. 1878.)—This is the *Frenzelite* of Dana's Mineralogy, 5th Ed., 2nd appendix—it was first noticed by Senor Castillo in March, 1873, as a sulpho-selenide of bismuth from Guanajuato, Mexico.

The analysis now given is as follows :—

Selenium	31·64
Sulphur	·61
Bismuth	59·92
Alumina	2·53
Ferric Oxide	tr
Silica..	3·47
Water	1·46
	99·63

This agrees very fairly with the formula $Bi_2 S_3$.

J. H. C.

Homilite (*Ann. Chem. et Phys.* v. xii. 1877).—This mineral described by Parjkull in Dec. 1876 as a silicoborate of iron and lime occurring with meliphanite and erdmannite on the island of Stockoë, near Brevig, is regarded by M. M. Damour and Descloiseaux as a mixture, on chemical and optical grounds.

Correspondence and Notes.

To the Editor of the Mineralogical Magazine.

Sir,

Mineralogists, Physicists, and I conceive, also, Geologists, must alike be grateful to Professor Church for introducing to their notice what we may for a time call *Sonstadt's specific gravity solution.*

The application of this, though clearly restricted, will be at one and the same time rapid and precise. Two of the properties of this solution cannot however be too soon impressed upon those who purpose to apply it.

It is a rapid and powerful vesicant, and it is frightfully poisonous.

It so happened that while preparing a quantity of this so called "solution," some drops thereof fell upon one of my hands; these drops were too hastily rubbed off, before drawing on my gloves to run to catch a train.

Some half hour thereafter a stinging sensation caused me to withdraw the glove, when I found my hand to be in a state of violent inflammation.

I did not use my tongue, but, being in the train, I had to repeatedly use my handkerchief, moistened with what was on my tongue, with the result that I had to hold the latter, almost in a double sense, for the rest of the day.

I have used above the expression "the so called solution," because it really is not a solution of mercury bichloride in potassium iodide which is being formed, were it so, the peculiar intermittance or alternation of the action of the solvents would be most difficult of explanation upon the known laws of adhesion.

It is a *new salt* which is being produced—this salt can be separated by slow cooling in needle crystals of some three inches in length—apparently belong to the oblique prismatic system—have a high dispersive power—a sulphur yellow colour, and are extremely deliquescent.

To emphacise my warning as to the properties of the liquid, I sign myself,

M. FORSTER HEDDLE, M.D.

St. Andrews, March, 1878.

———o———

CAPTAIN MARSHALL HALL would be very glad to hear of any mineralogists likely to visit the Lötschenthal and the Val d'Anniviers during the coming summer. The best rendezvous would be the Hotel et Pension, Bauer, Sierre.—Scientific Club, 7, Savile Row, W.

A Société de Mineralogie has been formed at Paris, with M. Des Cloiseaux as President. It meets on the second Tuesday of each month in the Mineralogical Laboratory of the Sorbonne.

Obituary.

THE RIGHT HONORABLE LORD KINNAIRD K.T., a fellow of the Geological Society and a member of the Mineralogical Society, died of inflammation of the lungs at Rossie Priory, in December, 1877. He was born in 1807, and succeeded his father in 1826. He was one of the original members of the Mineralogical Society.

The Rev. C. M. EDWARD COLLINS died at his seat of Trewardale, Bodmin, on the 3rd of Dec., 1877, aged 62. He was one of the original members of the Mineralogical Society.

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